OCCUPATIONAL ANALYSES SERIES

Refrigeration and Air Conditioning Mechanic

2004

Human Resources and Skills Development Canada
Ressources humaines et Développement des compétences Canada
Canada

Occupational Analyses Series

Refrigeration and Air Conditioning Mechanic

2004

Trades and Apprenticeship Division

Human Resources
Partnerships Directorate

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The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this occupational analysis as the national standard for the occupation of refrigeration and air conditioning mechanic.

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This analysis was prepared by the Human Resources Partnerships Directorate of HRSDC. The overall planning and coordination of the development of this analysis were undertaken by staff members of HRSDC's Trades and Apprenticeship Division.

OTHER RELATED OCCUPATIONAL TITLES

This analysis covers tasks performed by a refrigeration and air conditioning mechanic whose occupational title has been identified by some provinces and territories of Canada under the following names:

- Pipefitter – Refrigeration Mechanic Specialty
- Refrigeration and Air Conditioning
- Refrigeration and Air Conditioning Mechanic
- Refrigeration Mechanic

LIST OF PUBLISHED OCCUPATIONAL ANALYSES*

TITLE	NOC** Code
Appliance Service Technician (1997)	7332
Aquaculture Technician (1977)	2221
Arts Administrator (1989)	0114
Automotive Painter (1995)	7322
Automotive Service Technician (1998)	7321
Automotive Technician - Automatic Transmission (1990)	7321
Automotive Technician - Electrical/Electronics (1992)	7321
Automotive Technician - Engine Repair and Fuel Systems (1989)	7321
Automotive Technician - Front-End (1989)	7321
Automotive Technician - Manual Transmission, Driveline and Brakes (1990)	7321
Aviation Machinist (1994)	7231
Baker (1997)	6252
Blaster (Surface) (1987)	7372
Boilermaker (2003)	7262
Bricklayer (2000)	7281
Cabinetmaker (2000)	7272
Carpenter (1998)	7271
Cement Finisher (1995)	7282
Construction Electrician (2003)	7241
Cook (2003)	6242
Electrical Rewind Mechanic (1999)	7333
Electronics Technician - Consumer Products (1997)	2242
Electronics Technician Vol. I (1986) (Video Equipment)	2242
Electronics Technician Vol. II (1986) (Audio Equipment)	2242

* **Red Seal analyses are indicated in bold.**
** **National Occupational Classification**

Electronics Technician Vol. III (1986) (Computer Equipment)	2242
Electronics Technician Vol. IV (1986) (Office Equipment)	2242
Electronics Technician Vol. VI (1986) (Communication Equipment)	2242
Electronics Technician Vol. VII (1986) (Signaling Equipment)	2242
Electronics Technician Vol. VIII (1986) (Navigation Equipment)	2242
Electronics Technician Vol. IX (1986) (Video Game Equipment)	2242
Electronics Technician Vol. X (1987) (CADD Equipment)	2242
Electronics Technician Vol. XI (1987) (CAM Equipment)	2242
Electronics Technician Vol. XII (1987) (Robotics Equipment)	2242
Electronics Technician Vol. XIII (1987) (Biomedical and Laboratory Equipment)	2242
Electronics Technician Vol. XIV (1987) (Industrial Process-Control Equipment)	2243
Farm Equipment Mechanic (2000)	7312
Floorcovering Installer (1997)	7295
Glazier (2004)	7292
Hairstylist (1997)	6271
Heating (Gas and Oil) Servicer - Commercial and Industrial (1978)	7331
Heavy Duty Equipment Mechanic (1998)	7312
Industrial Electrician (2003)	7242
Industrial Instrument Mechanic (2000)	2243
Industrial Mechanic (Millwright) (1999)	7311
Insulator (Heat and Frost) (2000)	7293
Ironworker (Generalist) (1993)	7264
Lather (Interior Systems Mechanic) (2002)	7284
Logistics (1992)	0713

Machinist (1998)	7231
Major Electrical Appliance Repairer (1984)	7332
Metal Fabricator (Fitter) (2003)	7263
Mobile Crane Operator (1997)	7371
Motorcycle Mechanic (1995)	7334
Motor Vehicle Body Repairer (Metal and Paint) (1997)	7322
New Home Builder and Residential Renovation Contractor (1992)	0712
Oil Burner Mechanic (1997)	7331
Painter and Decorator (2000)	7294
Partsperson (1995)	1472
Plumber (2003)	7251
Power Engineer (1997)	7351
Powerline Technician (2004)	7244
Recreation Vehicle Mechanic (2000)	7383
Refrigeration and Air Conditioning Mechanic (2004)	7313
Roofer (1997)	7291
Sheet Metal Worker (1997)	7261
Sprinkler System Installer (2003)	7252
Steamfitter-Pipefitter (1996)	7252
Tilesetter (2004)	7283
Tool and Die Maker (1997)	7232
Transport Trailer Technician (2003)	7321
Truck and Transport Mechanic (2000)	7321
Welder (2004)	7265

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FOREWORD

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to co-operate with provincial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Human Resources and Skills Development Canada sponsors a program, under the guidance of the Canadian Council of Directors of Apprenticeship (CCDA), to develop a series of occupational analyses.

The Occupational Analysis Program has the following objectives:

- to identify and group the tasks performed by skilled workers in particular occupations;
- to identify those tasks that are performed by skilled workers in every province and territory;
- to develop instruments for use in the preparation of interprovincial standards "Red Seal" examinations and curricula for training leading to the certification of skilled workers;
- to facilitate the mobility, in Canada, of trainees and skilled workers; and
- to supply employers and employees, and their associations, industries, training institutions and governments with analyses of the tasks performed in particular occupations.

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GUIDE TO ANALYSIS

DEVELOPMENT OF ANALYSIS

A draft analysis is developed by a knowledgeable consultant who, with the assistance of a committee of industry experts in the field, identifies all the tasks performed in the occupation.

The draft is then assigned to occupational analysts at Human Resources and Skills Development Canada for translation and then returned to the consultant for review to ensure conformity with the nationally approved format.

The consultant will then forward a copy of this analysis to provincial/territorial authorities for validation by specialists in the field. Their recommendations are assessed and incorporated into the final draft which also includes the identification of the common core tasks performed in the occupation.

The occupational analysis is published in both official languages.

STRUCTURE OF ANALYSIS

To facilitate understanding of the nature of the occupation, the work performed is divided into the following divisions:

A. **BLOCK** – is the largest division within the analysis and reflects a distinct operation relevant to the occupation.

B. **TASK** – is the distinct activity that, combined with others, makes up the logical and necessary steps the worker is required to perform to complete a specific assignment within a "BLOCK".

C. **SUB-TASK** – is the smallest division into which it is practical to subdivide any work activity and, combined with others, fully describes all duties constituting a "TASK".

Supporting Knowledge & Abilities

The element of skill and knowledge that an individual must acquire to adequately perform the task is identified under this heading.

Trends

Any shifts or changes in technology which affects the block are identified under this heading.

Related Components

All components of a specified task being undertaken by the refrigeration and air conditioning mechanic are identified under this heading.

Tools and Equipment

All tools and equipment necessary for the refrigeration and air conditioning mechanic to complete a task are identified under this heading.

VALIDATION METHOD

At the request of the Canadian Council of Directors of Apprenticeship (CCDA), the Standardization Sub-committee developed a method for the validation of the national Red Seal occupational analyses.

A draft of the analysis is sent to all provinces/territories for validation. Each jurisdiction rates the sub-tasks and applies percentage ratings to blocks and tasks. This method for the validation of the national occupational analysis identifies common core tasks across Canada for a specific occupation. This feature facilitates the weighting of the Interprovincial Red Seal examinations.

DEFINITIONS

YES: the sub-task is performed by workers in the occupation in a specific jurisdiction.

NO: the sub-task is not performed by workers in the occupation in a specific jurisdiction.

BLOCK %: the average number of questions (items), derived from the collective decision made by workers within the occupation from all areas of Canada, which will be placed on an interprovincial examination to assess each block of the analysis.

TASK %: the average number of questions (items), derived from the collective decision made by workers within the occupation from all areas of Canada, which will be placed on an interprovincial examination to assess each task of the analysis.

NV: Not Validated by a province/territory.

ND: Not Designated in a province/territory.

PROVINCIAL/TERRITORIAL ABREVIATIONS

NL:	Newfoundland and Labrador
NS:	Nova Scotia
PE:	Prince Edward Island
NB:	New Brunswick
QC:	Quebec
ON:	Ontario
MB:	Manitoba
SK:	Saskatchewan
AB:	Alberta
BC:	British Columbia
NT:	Northwest Territories
YK:	Yukon
NU:	Nunavut

COMMON CORE

The criteria for determining common core are dependant on the performance of sub-tasks. If 70% of the responding jurisdictions (excluding NVs and NDs) perform the sub-task, it shall be considered common core.

Interprovincial Red Seal examinations are based on the common core identified through this validation process. This process identifies what will be assessed through the interprovincial examination.

BLOCKS AND TASKS WEIGHTING (APPENDIX "B")

This appendix represents the block and task percentages as submitted by each jurisdiction.

Each jurisdiction, with the use of a provincial/territorial occupational advisory committee, validates the content, places percentages on blocks and tasks, and indicates whether or not the sub-tasks are performed by the skilled workers within the occupation. The results of this exercise are submitted to the consultant who then analyses the data and develops this appendix which provides the individual jurisdictional validation results as well as the national averages of all responses.

PIE CHART (APPENDIX "C")

The graph depicts the national percentages assigned to blocks in the analysis.

SCOPE OF THE RERIGERATION AND AIR CONDITIONING MECHANIC

The term "refrigeration and air conditioning mechanic" defines a person who is capable of diagnosing, repairing, installing and maintaining a variety of refrigeration and air conditioning systems such as mobile, artificial ice rink, self-contained and split systems. Refrigeration and air conditioning mechanics are employed in the product refrigeration, commercial, industrial, residential, institutional and recreational sectors. These people work in a variety of companies, government, and institutions. Refrigeration and air conditioning mechanics could be self-employed as contractors, work in pulp mills, packing plants, mines, refineries, fish plants and chemical plants. Engineering and consulting firms, building management, and equipment manufacturing companies may employ these mechanics. Refrigeration and air conditioning mechanics may report directly to the following people: construction foremen/supervisors, service foremen/supervisors, service managers or company owners. Reporting directly to them may be: maintenance workers, labourers and apprentices.

Refrigeration and air conditioning mechanics also diagnose, repair, install and maintain a variety of refrigeration and air conditioning systems including: air handling, cooling, heating, humidification, ventilation and air exchange, air cleaning, cooling towers, evaporative condensers and heat pump equipment, controls and control circuitry as well as assemble walk-in boxes and install display cases, freezers, freezer plants, over the road refrigeration, blast food freezing, ice making equipment, electronic and automated controls, ultra low applications and controlled environments.

The refrigeration and air conditioning mechanics have the knowledge, skills and abilities to use trade tools, test instruments, elements of refrigeration, refrigerants and oils, and to apply codes and regulations. They also have knowledge of safety, electricity, electronics, electric motors, microprocessors, troubleshooting, blueprint reading, sketching and drawing, brazing, rigging, hoisting, trade calculations, computer skills and customer relations. The mechanic will require a working knowledge of equipment and devices such as: compressors, condensers, receivers, evaporators, metering devices, piping of refrigeration systems, controls and control circuitry, cooling towers, circulating pumps, air handling, and distribution equipment.

As a result of the breadth of the occupation there may be a variety of levels of competence and some degree of specialization. This analysis covers the full range of competencies for the trade.

Aspects of this occupation (centrifugal, absorption and ammonia installation and repair, and ultra low applications) are highly specialized, and involve few workers.

OCCUPATIONAL OBSERVATIONS

The refrigeration and air conditioning mechanic continues to be challenged by technological advances in the industry, including a larger proliferation of refrigerants and oils, and increasingly sophisticated electronic controls.

Refrigeration and air conditioning have more hybrid systems. An increased number and types of refrigerants and oils pose compatibility problems, and personal and environmental concerns.

The mechanic is faced with an increased use of electronic monitoring equipment used on indoor air quality equipment, as well as new methods of energy recovery ventilation.

Humidification equipment has an increased use of more sophisticated electronic control systems. There is also a greater use of reverse osmosis in filtering systems.

Heating systems use more automated and microprocessor controls with a greater application of heat reclaim in systems to reduce energy costs. The consumer is looking for greater efficiencies in both heating and cooling.

There is an increased use of computers related to control systems that requires the mechanic to have an increased proficiency with computerized diagnostic test equipment. There is a decrease in the use of pneumatic and mechanical controls requiring the mechanic to have an increased knowledge of automated controls. The refrigeration and air conditioning mechanic must continue to possess a high degree of product knowledge and exceptional skills in customer relations in response to consumers' increasingly informed requests.

SAFETY

Safe working procedures and conditions, accident prevention and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties are aware of circumstances and conditions that may lead to injury or harm. Safe learning experiences and environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

It is generally recognized that a safety-conscious attitude and work practices contribute to a healthy, safe and accident-free working environment.

It is imperative to apply and be familiar with the Occupational Health and Safety Acts and Workplace Hazardous Material Information System (WHMIS) Regulations. As well, it's essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

As safety education is an integral part of training in all jurisdictions, personal safety practices are not recorded in this document. However, the technical safety aspect relating to each task and sub-task are included throughout this analysis.

ANALYSIS

BLOCK A

FUNDAMENTAL OCCUPATIONAL SKILLS

Trends: *Use of new estimating systems; towards use of electronic service processing of documentation such as paperless dispatch and invoicing; advanced personal communication such as pagers and cell phones; increased Internet documentation and technical services; use of artificially intelligent diagnostic tools; increased use of CAD; increased government regulations; increased safety standards; and increased environmental awareness.*

Task 1 **Utilizes mechanical and architectural drawings, acts, codes, standards, legislation, and service and operating manuals.**

Related Components: Structural drawings, wiring diagrams, electrical and electronic schematics, layout drawings, blueprints, service manuals, operating manuals, safety manuals, technical bulletins, standard operating procedures, federal and provincial regulations, federal, provincial, electrical acts, codes, legislation, regulations, amendments.

Tools and Equipment: Computers, rulers, printers, scanners, plotters, DVD/CD ROMs, projectors, VCR, scale rules, scribing tools, calculators, quick selection charts, conversion tables.

Sub-task

1.01 **Interprets blueprints, drawings and schematics.**

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

1.01.01 knowledge of types and formats of drawings and schematics

1.01.02 knowledge of drawing conventions

1.01.03 knowledge of information contained on drawings and schematics such as dimensions, tolerances and components

1.01.04 knowledge of system drawings

1.01.05 ability to recognize symbols and abbreviations

Supporting Knowledge & Abilities

1.01.06	ability to calculate dimensions
1.01.07	ability to visualize three dimensional structures, components, piping and ducting
1.01.08	ability to perform unit conversions
1.01.09	ability to document changes to drawings and schematics
1.01.10	ability to prepare sketches

Sub-task

1.02 Interprets service and operating manuals, technical bulletins and warranties.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

1.02.01	knowledge of operation of equipment and components
1.02.02	knowledge of service/operating manuals
1.02.03	knowledge of technical bulletins
1.02.04	knowledge of warranties
1.02.05	knowledge of equipment specifications
1.02.06	ability to locate product information, operating service procedures and maintenance schedules
1.02.07	ability to access information from the Internet, compact discs or supplier/manufacturer representative
1.02.08	ability to recognize need for and locate technical updates and technical bulletins

Sub-task

1.03 Interprets tables, charts and diagrams.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

1.03.01 knowledge of types of refrigeration tables, charts and diagrams

1.03.02 knowledge of refrigeration and electrical and gas, acts, codes, legislation, regulations and specifications

1.03.03 ability to recognize mechanical, electrical, pneumatic, electronic and communication symbols and abbreviations

Sub-task

1.04 Interprets manufacturer's specifications.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

1.04.01 knowledge of operating conditions such as voltage, pressures, amperage, capacities and temperature

1.04.02 knowledge of design data such as tolerances, dimensions, weights, sound ratings, vibrations, volumes and speed

1.04.03 knowledge of energy consumptions

1.04.04 ability to recognize inconsistencies between specifications and equipment

1.04.05 ability to recognize limitations of equipment design

Sub-task

1.05 Complies with government acts, codes, standards and regulations.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

1.05.01	knowledge of government standards and regulations such as OHSA, ASHRAE, WHMIS and TDG
1.05.02	knowledge of safety regulations, inspections and standards
1.05.03	knowledge of federal, provincial/territorial and municipal codes and by-laws such as fire, gas, building, plumbing and electrical
1.05.04	knowledge of types of permits such as electrical, gas, mechanical and hoisting
1.05.05	knowledge of procedures to obtain permits and inspections
1.05.06	ability to locate and access standards, codes and regulations
1.05.07	ability to apply standards, codes and regulations
1.05.08	ability to document inspections

Task 2 **Operates and maintains tools and equipment.**

Related Components: None.

Tools and Equipment: As per tools and equipment list shown in Appendix "A".

Sub-task

2.01 **Utilizes hand tools.**

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

2.01.01 knowledge of types and function of common hand tools

2.01.02 knowledge of metric and imperial tool sizes

2.01.03 knowledge of operating procedures and techniques for hand tools

2.01.04 ability to select hand tools required for task to be performed

2.01.05 ability to clean and lubricate hand tools

2.01.06 ability to store hand tools

2.01.07 ability to perform minor repairs such as sharpening, straightening and cleaning

2.01.08 ability to calibrate hand tools

Sub-task

2.02 **Utilizes portable and stationary power tools.**

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

2.02.01 knowledge of types and functions of air, electric and hydraulic portable and stationary power tools

2.02.02 knowledge of operating procedures for air, electric and hydraulic portable and stationary power tools

Supporting Knowledge & Abilities

2.02.03	knowledge of capabilities and limitations of air, electric and hydraulic portable and stationary power tools
2.02.04	knowledge of power supply requirements for selected portable and stationary power tools
2.02.05	knowledge of maintenance schedules for equipment
2.02.06	ability to select the portable and stationary power tools for the job to be performed
2.02.07	ability to clean and lubricate portable and stationary power tools
2.02.08	ability to perform minor repairs such as replacing power cord ends, air line connectors and hydraulic or air hoses
2.02.09	ability to store portable power tools
2.02.10	ability to calibrate power tools

Sub-task

2.03 Utilizes oxy-fuel and air-fuel equipment.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

2.03.01	knowledge of types and functions of oxy-fuel and air-fuel equipment
2.03.02	knowledge of operating procedures for oxy-fuel and air-fuel equipment
2.03.03	knowledge of capabilities and limitations of oxy-fuel and air-fuel equipment
2.03.04	knowledge of local fire codes and safety legislation
2.03.05	ability to select oxy-fuel and air-fuel equipment for the job to be performed

Supporting Knowledge & Abilities

2.03.06	ability to clean oxy-fuel and air-fuel equipment
2.03.07	ability to perform minor repairs such as replacing o-rings, hoses and gauges, and tightening connections
2.03.08	ability to store, transport and secure oxy-fuel and air-fuel equipment

Sub-task

2.04 Utilizes recovery and recycle equipment.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

2.04.01	knowledge of government legislation, codes and regulations
2.04.02	knowledge of types, functions and limitations of recovery and recycle equipment
2.04.03	knowledge of application of recovery and recycle equipment to refrigeration and air conditioning systems
2.04.04	knowledge of types of refrigerants and oils and their compositions
2.04.05	knowledge of techniques and procedures to recover and recycle refrigerants and oils
2.04.06	knowledge of handling and storage techniques for refrigerants and oils
2.04.07	ability to operate recovery and recycle equipment
2.04.08	ability to maintain recovery and recycle equipment
2.04.09	ability to transport recovered and recycled refrigerants and oils

Sub-task

2.05 Utilizes evacuation equipment and tools.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

2.05.01 knowledge of government legislation, codes and regulations

2.05.02 knowledge of types and functions of evacuation equipment and tools

2.05.03 knowledge of techniques and procedures for evacuation and dehydration of refrigeration and air conditioning systems

2.05.04 knowledge of vacuum levels and durations required for refrigeration and air conditioning application

2.05.05 knowledge of effects of temperature, electrical connections, power interruptions and line sizing on evacuation

2.05.06 ability to operate evacuation equipment and tools

2.05.07 ability to maintain evacuation equipment and tools such as replacing vacuum pump oil

2.05.08 ability to interpret vacuum readings to adequately evacuate and dehydrate

Sub-task

2.06 Utilizes charging equipment and tools.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

2.06.01 knowledge of government legislation and regulations

2.06.02 knowledge of types and functions of charging equipment and tools such as charging cylinders, charging scales and sight glass

Supporting Knowledge & Abilities

2.06.03	knowledge of techniques and procedures for operation of charging equipment and tools
2.06.04	knowledge of refrigerant types and properties
2.06.05	ability to calculate system refrigerant charge
2.06.06	ability to interpret name plate data
2.06.07	ability to interpret manufacturer's charging instructions
2.06.08	ability to operate charging equipment and tools
2.06.09	ability to maintain charging equipment and tools

Sub-task

2.07 Utilizes access/egress equipment.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

2.07.01	knowledge of types of access/egress equipment such as ladders, staging and scaffolding
2.07.02	knowledge of load bearing capacity of access equipment
2.07.03	knowledge of standards, specifications and regulations for access equipment such as Occupational Health and Safety Regulations
2.07.04	ability to secure access equipment
2.07.05	ability to employ fall arrest equipment such as harnesses, safety belts and lines
2.07.06	ability to erect, dismantle and maintain stationary/rolling scaffolding
2.07.07	ability to erect, dismantle and maintain staging

Sub-task

2.08 Utilizes hoisting and rigging equipment.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

2.08.01 knowledge of government legislation, codes and regulations

2.08.02 knowledge of types and functions of hoisting, tugging and lifting devices such as jacks, hoists and come-alongs

2.08.03 knowledge of types and functions of rigging equipment such as belts, ropes, cables and slings

2.08.04 knowledge of operating procedures and techniques for hoisting, tugging and lifting devices

2.08.05 knowledge of hoisting, tugging and lifting capacities

2.08.06 ability to determine loads and weights

2.08.07 ability to clean, lubricate and store rigging, hoisting, tugging and lifting devices

2.08.08 ability to recognize damaged, worn, defective and leaking components

2.08.09 ability to perform minor repairs and replenish fluids

Sub-task

2.09 Utilizes mechanical measuring equipment.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

2.09.01 knowledge of types and functions of mechanical measuring equipment such as vernier calipers, micrometers and dial indicators

Supporting Knowledge & Abilities

2.09.02	knowledge of operating procedures for mechanical measuring equipment
2.09.03	knowledge of handling and storage requirements for mechanical measuring equipment
2.09.04	ability to check mechanical measuring equipment for accuracy and calibration
2.09.05	ability to convert between metric and imperial measurements
2.09.06	ability to identify damaged or worn mechanical measuring equipment
2.09.07	ability to clean mechanical measuring equipment
2.09.08	ability to store mechanical measuring equipment
2.09.09	ability to calibrate mechanical measuring equipment

Sub-task

2.10 Utilizes electric and electronic diagnostic tools.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

2.10.01	knowledge of types and functions of electric and electronic diagnostic tools
2.10.02	knowledge of proper care and handling of electric and electronic diagnostic tools
2.10.03	knowledge of operating procedures for electric and electronic diagnostic tools
2.10.04	knowledge of capabilities and limitations of electric and electronic diagnostic tools
2.10.05	ability to interpret readings and fault codes

Supporting Knowledge & Abilities

2.10.06 ability to hook up electric and electronic diagnostic tools

2.10.07 ability to perform minor maintenance such as changing batteries or cleaning connectors

2.10.08 ability to store electric and electronic diagnostic tools

2.10.09 ability to calibrate electric and electronic diagnostic tools

Sub-task

2.11 Utilizes computer equipment to interface with refrigeration and air conditioning systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

2.11.01 knowledge of techniques and procedures to interface computer equipment with refrigeration and air conditioning systems

2.11.02 knowledge of hardware and software requirements

2.11.03 knowledge of computer operations

2.11.04 knowledge of manufacturer's specifications

2.11.05 ability to interface computer to refrigeration and air conditioning automated control system

2.11.06 ability to confirm communication link with refrigeration and air conditioning system

Task 3 **Demonstrates work practices and procedures.**

Related Components: None.

Tools and Equipment: Common hand tools, power tools, hoisting, rigging and lifting equipment, measuring and testing instruments.

Sub-task

3.01 **Installs fasteners, brackets and hangers.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

3.01.01	knowledge of types, styles, purposes and sizes of fasteners, brackets and hangers
3.01.02	knowledge of capabilities and limitations of fasteners, brackets and hangers
3.01.03	knowledge of replacement procedures and techniques for fasteners, brackets and hangers
3.01.04	knowledge of torque limits
3.01.05	knowledge of required lubricants and sealants on fittings, brackets and hangers
3.01.06	knowledge of isolation, vibration and seismic conditions
3.01.07	ability to select fasteners, brackets and hangers compatible with job specifications
3.01.08	ability to torque fasteners
3.01.09	ability to lubricate and seal fasteners
3.01.10	ability to apply fasteners for seismic loads

Sub-task

3.02 Performs lock-out tagging and isolation procedures.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

3.02.01	knowledge of hazardous energy sources
3.02.02	knowledge of lock-out, tag-out, blank-off and hold-off procedures and techniques
3.02.03	knowledge of site lock-out procedures
3.02.04	ability to implement hazardous energy lock-out and tag-out procedures
3.02.05	ability to affix restraints, tags and signage

Sub-task

3.03 Installs piping and tubing.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

3.03.01	knowledge of types and sizes of piping and tubing and their applications
3.03.02	knowledge of specific techniques and procedures such as soldering, brazing, threading, flaring, swaging, compression and barbed fittings to join material types
3.03.03	knowledge of components to be joined
3.03.04	knowledge of techniques for piping practices such as nitrogen purging, pre- and post-cleaning, piping and tubing supports
3.03.05	knowledge of applications requiring piping and tubing such as refrigeration and air conditioning, secondary refrigerant, water and pneumatic
3.03.06	ability to mount and secure piping and tubing

Supporting Knowledge & Abilities

3.03.07	ability to cut, prep and join piping and tubing such as soldering compression fittings and brazing
3.03.08	ability to connect piping and tubing to components
3.03.09	ability to bend, flare, ream, or thread and swage piping and tubing
3.03.10	ability to route piping and tubing

Sub-task

3.04 Applies sealants and adhesives.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

3.04.01	knowledge of types and properties of adhesives and sealants
3.04.02	knowledge of application techniques for sealants and adhesives
3.04.03	ability to apply sealants and adhesives

Sub-task

3.05 Cleans and lubricates parts and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

3.05.01	knowledge of cleaning equipment
3.05.02	knowledge of lubricating equipment
3.05.03	knowledge of characteristics, applications, qualities and capabilities of lubricants and cleaners
3.05.04	knowledge of cleaning and lubricating equipment operating procedures and techniques

Supporting Knowledge & Abilities

3.05.05	knowledge of personal and work area protective equipment
3.05.06	knowledge of ventilation requirements
3.05.07	knowledge of environmental protection requirements for cleaners and lubricants such as recovery, disposal, storage and handling
3.05.08	ability to apply lubricants
3.05.09	ability to operate cleaning equipment
3.05.10	ability to operate lubricating equipment

Sub-task

3.06 Performs internal electrical wiring of systems.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

3.06.01	knowledge of types, sizes and gauges of wire
3.06.02	knowledge of electrical requirements of the system and components
3.06.03	knowledge of internal power wiring procedures and techniques
3.06.04	knowledge of termination procedures and techniques
3.06.05	ability to select wire size and type compatible with the application
3.06.06	ability to cut, join and crimp wiring
3.06.07	ability to label, verify and record installation of internal wiring of system
3.06.08	ability to check continuity of wiring
3.06.09	ability to route and secure internal wiring of system
3.06.10	ability to terminate internal wiring of system

Task 4 **Coordinates refrigeration and air conditioning installation and maintenance.**

Related Components: None.

Tools and Equipment: Computers.

Sub-task

4.01 **Estimates work requirements.**

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

4.01.01	knowledge of system specifications
4.01.02	knowledge of types, sizes, prices, sources and availability of parts and accessories
4.01.03	knowledge of substitute equipment, parts and accessories
4.01.04	ability to estimate quantities, times and costs

Sub-task

4.02 **Conducts work area inspection.**

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

4.02.01	knowledge of components to be installed
4.02.02	knowledge of inspection check lists
4.02.03	knowledge of equipment and system specifications
4.02.04	ability to recognize work area hazards
4.02.05	ability to select hoisting and rigging equipment
4.02.06	ability to document work area inspections

Sub-task

4.03 Coordinates work requirements.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

4.03.01	knowledge of coordination techniques
4.03.02	knowledge of equipment and system specifications
4.03.03	knowledge of suppliers, vendors and outside sub-trades
4.03.04	knowledge of material lists, work orders and permits
4.03.05	knowledge of service reports
4.03.06	ability to organize work
4.03.07	ability to consult with end user on a project
4.03.08	ability to process work orders
4.03.09	ability to confirm materials availability
4.03.10	ability to identify system specific tools and equipment
4.03.11	ability to select parts and equipment to correspond to system specifications
4.03.12	ability to store and secure equipment and accessories
4.03.13	ability to coordinate with other trades

Sub-task

4.04 Maintains customer relations.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

4.04.01	knowledge of warranties, guarantees, return and exchange policies

Supporting Knowledge & Abilities

4.04.02	knowledge of features and benefits of refrigeration and air conditioning systems
4.04.03	knowledge of customer service practices such as follow up
4.04.04	ability to respond to end user queries
4.04.05	ability to instruct end user on operation and maintenance
4.04.06	ability to clarify end user problems
4.04.07	ability to recommend corrective action
4.04.08	ability to process claim forms
4.04.09	ability to demonstrate features of equipment
4.04.10	ability to handle end user complaints
4.04.11	ability to recommend service and maintenance requirements
4.04.12	ability to solicit approval to perform service or maintenance requirements
4.04.13	ability to demonstrate equipment operation and maintenance
4.04.14	ability to follow up with end user on system performance

Sub-task

4.05 Clarifies end user problems with refrigeration and air conditioning systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

Supporting Knowledge & Abilities

4.05.01	knowledge of end user's system such as location, type of equipment and controls
4.05.02	knowledge of operation of equipment
4.05.03	knowledge of repair/maintenance history

Supporting Knowledge & Abilities

4.05.04	knowledge of common types of problems
4.05.05	ability to confirm end user contacts
4.05.06	ability to question client regarding problem
4.05.07	ability to qualify/paraphrase end user information
4.05.08	ability to interpret customer information
4.05.09	ability to develop troubleshooting plan of action

Sub-task

4.06 Completes work-related documentation.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

4.06.01	knowledge of required work-related documents such as repair orders, preventative/predictive maintenance sheets and government inspection forms
4.06.02	knowledge of information required for specific work-related documents such as work performed, date performed, signature, time required and parts replaced
4.06.03	knowledge of TDG (transport of dangerous goods) forms
4.06.04	ability to update service records such as equipment logs and service cards
4.06.05	ability to process manufacturer's pre-start-up and start-up sheets, purchase orders, warranties and material return sheets
4.06.06	ability to process TDG forms
4.06.07	ability to process refrigerant management records

Sub-task

4.07 Generates maintenance documentation.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

4.07.01	knowledge of normal machine operating conditions
4.07.02	knowledge of company's policy relating to reporting procedures
4.07.03	ability to log machine operating conditions
4.07.04	ability to organize operating information for report
4.07.05	ability to interpret operating conditions such as reading and work completed
4.07.06	ability to prepare reports and documentation

Task 5 Performs system components, accessories and materials acquisition and handling.

Related Components: None.

Tools and Equipment: Fork lifts, pump trucks, hoisting, rigging and lifting equipment, hand trucks.

Sub-task

5.01 Requisitions equipment.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

5.01.01	knowledge of equipment requirements
5.01.02	knowledge of equipment suppliers and vendors
5.01.03	knowledge of company rental and purchasing policies
5.01.04	ability to complete material order/requisition

Supporting Knowledge & Abilities

5.01.05 ability to track orders

5.01.06 ability to arrange and schedule deliveries

Sub-task

5.02 Receives materials/equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

5.02.01 knowledge of specifications for materials/equipment ordered

5.02.02 knowledge of transportation documents such as bills of lading, packing slips and invoices

5.02.03 knowledge of special storage requirements for received goods

5.02.04 ability to conduct visual inspection for damage and loss

5.02.05 ability to remove packaging material

5.02.06 ability to process packing slips, bills of lading, invoices and damage reports

5.02.07 ability to verify equipment specifications

Sub-task

5.03 Transfers equipment to designated location.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

Supporting Knowledge & Abilities

5.03.01 knowledge of designated destination

5.03.02 knowledge of equipment specifications

5.03.03 knowledge of rigging requirements

5.03.04 knowledge of special handling requirements

Supporting Knowledge & Abilities

5.03.05	knowledge of transfer permits, obstruction permits and transportation restrictions
5.03.06	ability to schedule transfer
5.03.07	ability to operate materials and handling equipment
5.03.08	ability to perform pre-site inspection

BLOCK B

REFRIGERATION AND AIR COOLING SYSTEMS

Trends: *Towards the greater use of hybrid systems, more types of refrigerants and oils, and associated compatibility problems. Environmental concerns and safety issues associated with new refrigerants, switching from reciprocating compressors, to scroll and screw type compressors. More sophisticated split systems.*

Task 6 Plans installation of refrigeration and air cooling systems.

Related Components: Equipment and components associated with the following diverse group of refrigeration systems including packaged and split (primary refrigeration systems, absorption systems, mobile refrigeration systems, air conditioning systems, ice machines, walk-in boxes, environmental rooms, supermarket equipment, heat pump systems, dehumidification and air dryers [self-contained and split], heat recovery systems, soft serve machines, slush and beverage machines, white goods, secondary refrigeration systems, ammonia systems, cascade systems, electronic refrigeration systems), refrigerants, oils, compressors, evaporators, metering devices, condensers or condensing units, isolation components, controls, piping, insulations, dryers, sight glasses, condensate drains, defrost circuits.

Tools and Equipment: Load calculation charts, compressor capacity charts, manufacturer's specifications for components, line sizing charts, computers, measuring and diagnostic tools and equipment, mechanical and architectural drawings, accessory specifications.

Sub-task

6.01 Verifies refrigeration and air cooling system parameters and requirements.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

6.01.01 knowledge of design criteria and parameters

Supporting Knowledge & Abilities

6.01.02 knowledge of trade engineering standards such as ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers)

6.01.03 knowledge of load calculation methods such as manufacturer's load charts and calculations

6.01.04 ability to apply load calculation methods

6.01.05 ability to calculate load

Sub-task

6.02 Selects refrigeration and air cooling components, equipment and accessories.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

6.02.01 knowledge of design criteria, parameters and code requirements

6.02.02 knowledge of types, sizes, capacities, limitations and applications of refrigeration and air cooling equipment, components and accessories

6.02.03 knowledge of manufacturer's specifications

6.02.04 knowledge of system requirements

6.02.05 ability to choose refrigeration and air cooling equipment/components/accessories to match application to optimize performance

Sub-task

6.03 Prepares components, equipment and accessories layout.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

6.03.01 knowledge of manufacturer's specifications

Supporting Knowledge & Abilities

6.03.02	knowledge of site restrictions
6.03.03	knowledge of function and application of components, equipment and accessories
6.03.04	knowledge of where components, equipment and accessories are located in system
6.03.05	ability to select locations of components, equipment and accessories for optimum performance and accessibility
6.03.06	ability to plan components, equipment and accessories locations
6.03.07	ability to assess external energy sources
6.03.08	ability to produce a layout plan

Sub-task

6.04 Selects refrigerant.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

6.04.01	knowledge of design criteria, parameters and mechanical codes
6.04.02	knowledge of refrigerant types and properties
6.04.03	knowledge of refrigerant performance
6.04.04	knowledge of manufacturer's requirements
6.04.05	ability to choose refrigerant for application

Sub-task

6.05 Sizes piping.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

6.05.01	knowledge of pipe sizing methods for fluids and gases such as primary/secondary refrigerant, fuels and water

Supporting Knowledge & Abilities

6.05.02 *knowledge of piping practices such as flow, velocity and oil return*

6.05.03 ability to select piping and tubing to match system requirements

Sub-task

6.06 Lays out piping.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

6.06.01 knowledge of layout methods and techniques

6.06.02 knowledge of manufacturer's recommended procedures

6.06.03 ability to produce a piping layout plan

Sub-task

6.07 Selects insulation.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

6.07.01 knowledge of types, application and ratings of insulation

6.07.02 knowledge of manufacturer's recommended application

6.07.03 ability to choose insulation for the application

Task 7 Installs refrigeration and air cooling systems.

Related Components: Refrigerants, oils, compressors (reciprocating, screw, scroll, rotary, centrifugal), condensers (air, water convection, evaporative), evaporators (direct, indirect), metering devices (high side float, low side float, expansion valves, capillary tubes, orifices), accessories (receivers, filter dryers, cooling towers, condenser water pumps, chill water pumps, circulating pumps, oil separators, suction accumulators, sight

glasses, mufflers, vibration eliminators, pressure regulating valves, check valves, pressure relief valves, isolation valves, solenoid valves, reversing valves, safety valves, pressure water valves, heat exchangers, suction stop valves, pressure operated controls, crankcase heaters, oil failure switches, oil pumps, external/internal capacity controls, defrost controls, oil coolers, purgers, temperature controls, flash tanks, sub-coolers), ammonia systems (low pressure receiver, liquid re-circulation pumps), absorption systems (solution pumps), ice makers (water pumps, augers, liquid level controls, auto cleaners), freezers/coolers (walk in boxes, erect, prefab boxes/panels, power doors, air curtains, mullion heaters, doors), environmental rooms (temperature, humidity, pressure recording), supermarkets (display cases, shelving, racks, lights, doors), heat pumps, dehumidifiers, water traps or water separators, heat recovery equipment, soft serve ice cream machines, slush machines, dispensing systems, air metering systems, electronic cooling units, frequency drives for compressors/generators, reciprocating engines, electric motors.

Tools and Equipment: Air fuel equipment, Allen keys, alignment tools, bending jigs, bending tools and springs, bolt cutters, brazing equipment, brushes, caulking guns, chalk lines, charging manifolds, charging cylinders, chisels, abrasive cloths/papers, crowbars, drills, drill index, electrical crimpers, fin combs, fish tapes, flaring tools, glue guns, grease guns, hand carts, hand sprayers, hazardous waste containers, hole saws, hoses, knock-out kits, labelling machines, ladders, litmus paper, nitrogen cylinders and regulators, o-ring removal tools, oxy-fuel equipment, orifice drill sets, padlocks, pipe cutters, pipe dies, pipe threaders, Pitot tubes, powder-actuated tools, power washers, printers, pullers, punches, reamers, recovery/recycle units, refrigerant oil pumps, retrieval and storage equipment, saws, scrapers, screw extractors, socket sets, soldering equipment (iron, gun), squares, staplers, straight edges, swaging tools, tap and die sets, tin snips, transfer pumps, trouble lights, tube cutters, two-way radios, utility knives, vacuum cleaners, vacuum pumps, wrenches, common hand tools, calipers, compound gauges, feeler gauges, leak detectors, service manifold sets, micrometers, micron gauges, vacuum gauges, vernier calipers, weigh scales.

Sub-task

7.01 Prepares site/location.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

7.01.01 knowledge of specifications of refrigeration and air conditioning equipment such as size, weight and capacity

7.01.02 knowledge of installation requirements related to utilities, roofing and structure support

7.01.03 ability to schedule project activities related to sub-trades and end user deadlines

7.01.04 ability to calculate labour requirements

7.01.05 ability to schedule project teams

7.01.06 ability to schedule connection of system to utilities

Sub-task

7.02 Assembles refrigeration and air cooling components, equipment and accessories.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

7.02.01 knowledge of equipment manufacturer's recommended assembly techniques and procedures

7.02.02 knowledge of equipment application

7.02.03 ability to remove protective material

7.02.04 ability to follow assembly instructions

7.02.05 ability to verify assembly

Sub-task

7.03 Positions and secures refrigeration and air cooling components, equipment and accessories.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

7.03.01 knowledge of equipment manufacturer's installation techniques and procedures

7.03.02 knowledge of isolation and vibration requirements

7.03.03 knowledge of service accessibility requirements

7.03.04 ability to select equipment location

7.03.05 ability to select fastening and positioning equipment and accessories

7.03.06 ability to anchor components, equipment and accessories in position

7.03.07 ability to verify installation of refrigeration and air cooling components, equipment and accessories

Sub-task

7.04 Routes and connects refrigerant piping.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

7.04.01 knowledge of piping layout

7.04.02 knowledge of techniques and procedures for routing and connecting refrigerant piping

7.04.03 knowledge of sizes and capacity of refrigerant piping

7.04.04 knowledge of vibration elimination and support requirements

Supporting Knowledge & Abilities

7.04.05	ability to interpret refrigerant piping schematics
7.04.06	ability to install refrigerant piping
7.04.07	ability to terminate refrigerant piping

Sub-task

7.05 Performs leak test on system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

7.05.01	knowledge of types and properties of refrigerants
7.05.02	knowledge of application of leak detectors
7.05.03	knowledge of techniques and procedures for leak testing
7.05.04	knowledge of site conditions such as temperature and hazards
7.05.05	ability to operate test equipment
7.05.06	ability to select test procedure for application
7.05.07	ability to interpret test results
7.05.08	ability to document test results

Sub-task

7.06 Evacuates system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

7.06.01	knowledge of vacuum pump fundamentals
7.06.02	ability to connect vacuum pump and vacuum gauge
7.06.03	ability to operate evacuation systems

Supporting Knowledge & Abilities

7.06.04 ability to interpret vacuum readings

Sub-task

7.07 Charges system.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

7.07.01 knowledge of refrigerant requirements such as volume, type and weight

7.07.02 knowledge of manufacturer's specifications for required refrigerant type

7.07.03 ability to weigh in refrigerant

7.07.04 ability to operate charging equipment

Task 8 Commissions refrigeration and air cooling systems.

Related Components: Equipment and components associated with the following diverse group of refrigeration systems including self-contained and split (primary refrigeration systems, absorption systems, mobile refrigeration systems, air conditioning systems, ice machines, walk-in boxes, environmental rooms, supermarket equipment, heat pump systems, dehumidification and air dryers [packaged and split], heat recovery systems, soft ice cream machines, slush and beverage machines, residential appliances, secondary refrigeration systems, ammonia systems, cascade systems, electronic refrigeration systems, humidification systems).

Tools and Equipment: Specifications of refrigeration and air conditioning systems, operating manuals, equipment/component specifications, start-up check lists, warranty checklists, Allen keys, alignment tools, calculators, charging manifolds, charging cylinders, computers, fuse pullers, hoses, ladders, litmus paper, local interfaces, padlocks, Pitot tubes, printers, straight edges, trouble lights, two-way radios, wrenches, common hand tools, scaffolding, air flow hoods, ammeters, anemometers, belt tension indicators, calipers, clamps, combustion analyzers, capacitor testers, compound gauges, data loggers, decibel meters, dial indicators, draft gauges, flame safeguard testers, flowmeters, meggers, micron gauges, milliammeters, multi-

meters, oxygen analyzers, phase meters, pneumatic calibration kits, potentiometers, refractometers, simulators (temperature, voltage, humidity, current, pressure), slings, psychrometers, smoke testers, sound level meters, spectrometers, stethoscopes, strobe lights, tachometers, tape measures, frequency meters, gas pressure gauges, infrared thermography cameras and display units, laptop computers, leak detectors, magnahelic gauges, manifold gauge sets, micrometers, manometers, temperature gauges, thermocouple testers, thermometers, vacuum gauges, velometers, vernier calipers, vibration analysis equipment, weigh scales.

Sub-task

8.01 Performs pre-start-up checks. **Supporting Knowledge & Abilities**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

8.01.01 knowledge of manufacturer's recommendations for pre-start inspection and source of energy

8.01.02 knowledge of available energy sources and utilities

8.01.03 ability to verify that equipment specifications match energy sources and utilities

8.01.04 ability to verify energy sources and utilities' connection integrity

8.01.05 ability to check phase rotation

8.01.06 ability to check isolation valve positions

8.01.07 ability to verify movement of drives and rotating equipment

8.01.08 ability to make adjustments

8.01.09 ability to complete pre-start-up sheets

Sub-task

8.02 Starts up refrigeration and air conditioning system.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

8.02.01	knowledge of manufacturer's recommended start-up procedures
8.02.02	knowledge of start-up procedures
8.02.03	knowledge of equipment application
8.02.04	knowledge of sequence of operation for system
8.02.05	ability to coordinate activation of utilities
8.02.06	ability to connect instrumentation
8.02.07	ability to follow manufacturer's recommended procedures for start-up
8.02.08	ability to make adjustments
8.02.09	ability to document start-up

Sub-task

8.03 Completes system charge.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

8.03.01	knowledge of pre-charge refrigerant weight and type
8.03.02	knowledge of charging procedures
8.03.03	knowledge of optimum operating conditions
8.03.04	knowledge of operation of regulating valves and metering devices
8.03.05	knowledge of operation of system equipment and components
8.03.06	ability to operate charging equipment

Supporting Knowledge & Abilities

8.03.07	ability to weigh added refrigerant
8.03.08	ability to measure operating conditions such as pressures and temperatures
8.03.09	ability to interpret operating conditions
8.03.10	ability to adjust operating components such as metering devices, pressure regulating valves, pneumatic controls, test operations and safety controls
8.03.11	ability to verify operation of safety controls

Sub-task

8.04 Sets up primary and secondary refrigeration system adjustable switches, valves and regulators.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

8.04.01	knowledge of operating control system for primary and secondary systems
8.04.02	knowledge of sequence of operation
8.04.03	knowledge of control application and function for primary and secondary systems
8.04.04	ability to adjust controls for primary and secondary systems
8.04.05	ability to interpret control readings for primary and secondary systems

Task 9 Maintains refrigeration and air cooling systems.

Related Components: Equipment and components associated with the following diverse group of refrigeration systems including self-contained and split (primary refrigeration systems, absorption systems, mobile refrigeration systems, air conditioning systems, ice machines, walk-in boxes, environmental rooms, supermarket equipment, heat pump systems, dehumidification

and air dryers [packaged and split], heat recovery systems, residential appliances, secondary refrigeration systems, cascade systems, electronic refrigeration systems), refrigerants, oils, compressors (reciprocating, screw, scroll, rotary, centrifugal), condensers (air, water convection, evaporative), evaporators (direct, indirect), metering devices (high side float, low side float, expansion valves, capillary tubes, orifices), accessories (receivers, filter dryers, cooling towers, condenser water pumps, chill water pumps, circulating pumps, oil separators, suction accumulators, sight glasses, mufflers, vibration eliminators, pressure regulating valves, check valves, pressure relief valves, isolation valves, solenoid valves, reversing valves, safety valves, pressure water valves, heat exchangers, suction stop valves, pressure operated controls, crankcase heaters, oil failure switches, oil pumps, external/internal capacity controls, defrost controls, oil coolers, purgers, temperature controls, flash tanks, sub-coolers), ammonia systems (low pressure receiver, liquid re-circulation pumps), absorption systems (solution pumps), ice makers (water pumps, augers, liquid level controls, auto cleaners), freezers/coolers (walk-in boxes, erect prefab boxes/panels, power doors, air curtains, mullion heaters, doors), environmental rooms (temperature, humidity, pressure recording), supermarkets (display cases, shelving, racks, lights, doors), heat pumps, dehumidifiers, water traps or water separators, heat recovery equipment, soft serve ice cream machines, slush machines, dispensing systems, air metering systems, electronic cooling units, frequency drives for compressors/generators, reciprocating engines, electric motors.

Tools and Equipment: System documentation, repair logs, repair histories, refrigerant logs, refrigerant change documentation, Allen keys, black lights, calculators, charging manifolds, computerized diagnostic equipment, computers, fuse pullers, ground fault detectors, ladders, litmus paper, local interfaces, nitrogen cylinders and regulators, padlocks, Pitot tubes, printers, trouble lights, two-way radios, wrenches (pipe, open end, adjustable, Allen), hoists, scaffolding, common hand tools, common measuring and testing instruments, air fuel equipment, alignment tools, bending jigs, bending tools and springs, bolt cutters, brazing equipment, brushes, caulking guns, chalk lines, charging cylinders, chisels, abrasives cloth/paper, crowbars, drill index, electrical crimpers, fin combs, fish tapes, flaring tools, glue guns, grease guns, hand carts, hand sprayers, hazardous waste containers, hack saws, hole saws, hoses, knock-out kits, labelling machines, regulators, o-ring removal tools, oxy-fuel equipment, orifice drill sets, padlocks, paint rollers, pipe cutters, pipe dies, pipe threaders, powder-actuated tools, power washers, pry bars, pullers, punches, reamers, recovery/recycle units, refrigerant

oil pumps, retrieval and storage equipment, saws, scrapers, screw extractors, socket sets, soldering equipment, squares, straight edges, swaging tools, tap and die sets, tin snips, transfer pumps, tube cutters, utility knives, vacuum cleaners, vacuum pumps, block and tackle, chains and cables, chain fall, come-alongs, cranes, dollies, eye bolts, fork lifts, Genie lifts, jacks, platform lifts, ropes, shackles, slings, staging winches, belt tension indicators, calipers, compound gauges, feeler gauges, leak detectors, manifold gauge sets, micrometers, micron gauges, multi-meters, rulers, tape measures, vacuum gauges, vernier calipers, weigh scales, access tools, air compressors and regulators, drills (hand, electric, cordless), purging units.

Sub-task

9.01 Inspects refrigeration and air cooling systems.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

9.01.01	knowledge of components of refrigeration and air cooling system
9.01.02	knowledge of equipment specifications and limitations
9.01.03	knowledge of equipment and system design
9.01.04	knowledge of inspection procedures and techniques
9.01.05	ability to conduct visual, physical, odour and noise examination of equipment for worn, damaged or fouled components
9.01.06	ability to recognize loose, worn, damaged or fouled components
9.01.07	ability to recommend corrective action

Sub-task

9.02 Tests electrical and electronic components.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

9.02.01	knowledge of electricity principles
9.02.02	knowledge of electrical and electronic test instruments
9.02.03	knowledge of types of components
9.02.04	knowledge of equipment electrical and electronic specifications
9.02.05	knowledge of equipment operation
9.02.06	knowledge of test procedures and techniques
9.02.07	ability to simulate a condition
9.02.08	ability to operate test instruments
9.02.09	ability to isolate electrical/electronic faults
9.02.10	ability to interpret and report test results

Sub-task

9.03 Tests mechanical components.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

9.03.01	knowledge of mechanical test instruments
9.03.02	knowledge of types of components
9.03.03	knowledge of equipment specifications
9.03.04	knowledge of equipment operation
9.03.05	knowledge of test procedures and techniques
9.03.06	ability to simulate an environmental condition

Supporting Knowledge & Abilities

9.03.07	ability to operate test equipment
9.03.08	ability to isolate mechanical faults
9.03.09	ability to interpret and report test results

Sub-task

9.04 Recommends corrective action.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

9.04.01	knowledge of repair/replacement procedures
9.04.02	knowledge of repair/replacement alternatives/options
9.04.03	knowledge of criteria such as cost, time and availability of equipment
9.04.04	knowledge of potential consequences of recommended action
9.04.05	knowledge of company repair/replacement policies
9.04.06	knowledge of warranties and maintenance agreements
9.04.07	ability to estimate repair/replacement costs
9.04.08	ability to determine repair options
9.04.09	ability to report fault and explain options to end user
9.04.10	ability to secure approval
9.04.11	ability to schedule repair
9.04.12	ability to prepare report

Sub-task

9.05 Selects refrigeration and air cooling equipment and components.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

9.05.01 knowledge of refrigeration and air cooling equipment/component specifications such as voltages and sizes

9.05.02 knowledge of refrigeration and air cooling equipment sources and availability

9.05.03 knowledge of equipment alternatives such as original equipment manufacturer or generic

9.05.04 knowledge of company acquisition policies such as preferred suppliers and purchasing procedures

9.05.05 knowledge of time constraints

9.05.06 ability to evaluate equipment options

9.05.07 ability to evaluate logistical requirements such as transportation

Sub-task

9.06 Replaces defective components and equipment.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

9.06.01 knowledge of required replacement procedures/techniques

9.06.02 knowledge of tools, equipment and resources required to complete job

9.06.03 knowledge of components and equipment limitations/specifications such as weight, capacity, voltages, limitations, tolerances and programming

9.06.04 ability to shut down system

Supporting Knowledge & Abilities

9.06.05	ability to isolate/lock out system
9.06.06	ability to access equipment and components
9.06.07	ability to dismantle equipment
9.06.08	ability to assemble equipment
9.06.09	ability to adjust equipment/components
9.06.10	ability to recover and dispose of refrigerant
9.06.11	ability to pressure test, evacuate and charge system

Sub-task

9.07 Repairs/overhauls defective components and equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

9.07.01	knowledge of repair/overhaul procedures and techniques
9.07.02	knowledge of equipment/component specifications including tolerances and limitations
9.07.03	ability to interpret manufacturer's specifications
9.07.04	ability to shut down system
9.07.05	ability to isolate/lock out and tag out system
9.07.06	ability to dismantle equipment
9.07.07	ability to assemble equipment
9.07.08	ability to recover refrigerant
9.07.09	ability to pressure test, evacuate and charge system
9.07.10	ability to fabricate components such as brackets, hangers and mounts

Supporting Knowledge & Abilities

9.07.11 ability to repair/replace defective parts

Sub-task

9.08 Verifies refrigeration and air cooling system and component function.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

9.08.01 knowledge of refrigeration and air conditioning equipment/component operation/function

9.08.02 knowledge of test equipment for refrigeration and air conditioning systems

9.08.03 knowledge of original design parameters

9.08.04 knowledge of equipment specifications such as capacity, voltages and sequence

9.08.05 ability to simulate an environmental condition

9.08.06 ability to test component operation for functionality

9.08.07 ability to interpret and report test results

Sub-task

9.09 Performs predictive maintenance.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

9.09.01 knowledge of predictive maintenance procedures

9.09.02 knowledge of non-destructive testing such as oil analysis, refrigerant analysis, eddy current and X-rays

9.09.03 ability to conduct non-destructive testing

Supporting Knowledge & Abilities

9.09.04	ability to operate test equipment
9.09.05	ability to interpret and report test results

Sub-task

9.10 Performs preventative maintenance.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

9.10.01	knowledge of preventative maintenance requirements such as schedule and manufacturer's recommendations
9.10.02	knowledge of preventative maintenance procedures
9.10.03	ability to assess the need to replace consumables
9.10.04	ability to replace consumables such as belts, filters, lubricants and electrical controls
9.10.05	ability to conduct maintenance activities such as cleaning, lubricating, tightening and adjusting
9.10.06	ability to return systems to operation

BLOCK C

HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS

Trends: *Greater application of air-to-air heat exchangers, geothermal systems, electronic monitoring of air quality oxygen and toxic gases, increased use of other containments, reclaiming heat from one area to another becoming more common, more glycol systems with heat pumps, heat recovery ventilation, energy recovery ventilation, recovery wheels, use of refrigerants to capture heat (commercial/industrial), and increased monitoring of indoor air quality. Greater application of variable speed drive systems, electronic damper controls, sensors and more interface with computers. Increased use of electronics to control systems, ultrasonic humidifiers (greater application to grocery store requirements), greater use of reverse osmosis in filtrating systems (scale and deposit). Humidified systems are high maintenance items for refrigeration and air conditioning heating technicians in grocery stores, supermarkets and commercial buildings. More automated and microprocessor controls, greater application of heat reclaim in systems to reduce energy costs, geothermal heat reclaim systems will increase as energy costs increase, heat pumps are becoming more efficient, greater use of modulated gas valves, greater efficiency of burners and greater expectations for personal comfort.*

Task 10 Plans installation of heating, ventilating and air conditioning systems.

Related Components: Air filtration systems including HEPA filters, water wash filtration equipment, roll filters, standard air filters, high efficiency filters, carbon filters, static filters, electronic air cleaners, sensors, air flow, exhaust fans, chemical treatments for area of high humidity and contamination, drain pans, evaporator coils, evaporative condensers, intake fans, supply air fans, fresh air components, air filtration components, ducting, fire isolation dampers, zone dampers, louvers, grills, diffusers, hangers, insulations, access doors, motorized damper controls, air flow sensors including return air and discharge air, temperature sensors, fire alarm systems including smoke alarms and heat rising alarms, water vaporization systems, electric boilers, propane and/or natural gas boilers, evaporator water systems, drum evaporators, plate evaporators, direct water systems, electronic atomizers, ultrasonic atomizers, water spray systems, steam injection systems, float valves, water pumps, sump pumps, electric motors, humidistat, monitoring gauges, cycling controls, burners, resistance coils/elements, direct fired and indirect fired, heat exchangers, induced draft fans, combustion air motors, electronic valves, controllers, ignition controllers, temperature controls, safety controls, thermocouples, flame rods, glow coils, electrodes, venting, combustion air, orifices,

manifolds, dampers, drains, gas valves, pumps, fuel tanks, pressure regulator valves, solenoids, plenum switches, operating controls, thermostat switches, pilot light assemblies, silicon-controlled rectifiers, solid state relays, relays, contactors, sequencers, carbon monoxide sensors.

Tools and Equipment: Manufacturer's specifications, design criteria, ducting drawings, parameters, calculators.

Sub-task

10.01 Verifies heating, ventilating and air conditioning systems, parameters and requirements.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

10.01.01	knowledge of design criteria and parameters
10.01.02	knowledge of types of heating, ventilating and air conditioning equipment and applications
10.01.03	knowledge of manufacturer's requirements
10.01.04	knowledge of energy sources available at site
10.01.05	knowledge of indoor poor air quality indicators
10.01.06	ability to verify the heating, ventilating and air conditioning systems design
10.01.07	ability to verify the heating, ventilating and air conditioning systems specifications
10.01.08	ability to test indoor air quality, air distribution and humidity
10.01.09	ability to match energy source with equipment requirements
10.01.10	ability to determine system needs with end user
10.01.11	ability to schedule utility connection

Sub-task

10.02 Selects heating, ventilating and air conditioning components and equipment.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

10.02.01	knowledge of types, sizes, capacities and applications of heating, ventilating and air conditioning equipment and components
10.02.02	knowledge of manufacturer's specifications
10.02.03	knowledge of site restrictions
10.02.04	knowledge of equipment/component function and application
10.02.05	knowledge of equipment/component location in systems
10.02.06	ability to choose heating, ventilating and air conditioning equipment/components to match applications
10.02.07	ability to plan heating, ventilating and air conditioning equipment and component location
10.02.08	ability to select equipment/component locations for optimum performance

Sub-task

10.03 Confirms heating, ventilating and air conditioning requirements.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

10.03.01	knowledge of heating, ventilating and air conditioning systems/components such as diffusers, grills, terminal devices, balancing dampers, boilers, evaporators and humidistats
10.03.02	knowledge of heat capacity

Supporting Knowledge & Abilities

10.03.03	knowledge of air flow/air quality psychrometric calculations and techniques
10.03.04	ability to calculate air flow/air quality requirements
10.03.05	ability to calculate heating capacity
10.03.06	ability to calculate psychrometric values such as quantity and quality

Task 11 Installs heating, ventilating and air conditioning systems.

Related Components: Air filtration systems including HEPA filters, water wash filtration equipment, roll filters, standard air filters, high efficiency filters, carbon filters, static filters, electronic air cleaners, sensors, air flow, other containments, exhaust fans, chemical treatments for area of high humidity and contamination, drain pans, evaporator coils, cooling towers, water towers, evaporator condensers, intake fans, supply air fans, wiring, controls, vanes, fans, fan motors, dampers, ducting, fire isolation dampers, zone dampers, louvers, grills, diffusers, hangers, insulations, access doors and panels, motorized damper controls, air flow sensors including return air and discharge air, temperature sensors, fire alarm systems including smoke alarm and heat rising alarm, electrical connections, electrical connectors, control connections, water vaporization systems, electric boilers, propane and/or natural gas boilers, evaporator water systems, drum evaporators, plate evaporators, direct water systems, electronic atomizers, ultrasonic atomizers, water spray systems, steam injection systems, float valves, water pumps, sump pumps, electric motors, humidistat, monitoring gauges, cycling controls, brackets, water lines, drain lines, electrical supplies, other fuel supplies, burners, resistance coils/elements, direct fired and indirect fired, heat exchangers, induced draft fans, combustion air motors, electronic valves, controllers, ignition controllers, temperature controls, safety controls, thermocouples, flame rods, glow coils, electrodes, venting, combustion air, orifices, manifolds, drains, gas valves, pumps, fuel tanks, pressure regulator valves, solenoids, plenum switches, operating controls, thermostat switches, pilot light assemblies, silicon-controlled rectifiers, solid state relays, relays, contactors, sequencers, carbon monoxide sensors, racks, utility supply, tubing, chimneys, roof curbs, pitch pockets.

Tools and Equipment: Access tools, Allen keys, alignment tools, bolt cutters, grease guns, caulking guns, chisels, cloths (sand, emery, sandpaper), crowbars, drills, electric crimpers, hand carts, hack saws, hole saws, insulation tapes, knock-out kits, labelling machines, ladders, pry bars, saws, socket sets, squares, levels, straight edges, tin snips, trouble lights, two-way radios, utility knives, wrenches, common hand tools, powder-actuated tools, hoisting and rigging equipment, hoses, air fuel systems, bending jigs, bending tools and springs, brazing equipment, flaring tools, pipe cutters, tube cutters, ammeters, volt meters, slings, psychrometers, tape measures, water analysis kits, air fuel equipment, conduit benders, hazardous waste containers, pipe dies, pipe threaders, tap and die sets.

Sub-task

11.01 Prepares heating, ventilating and air conditioning equipment site/location.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

11.01.01	knowledge of specifications of heating, ventilating and air conditioning equipment such as size, weight and capacity
11.01.02	knowledge of installation and equipment related to utilities, roofing, venting and structural support
11.01.03	ability to schedule project activities related to sub-trades and end user deadlines
11.01.04	ability to calculate labour requirements
11.01.05	ability to schedule project teams
11.01.06	ability to schedule connection of system to utilities

Sub-task

11.02 Assembles heating, ventilating and air conditioning equipment.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

11.02.01	knowledge of equipment manufacturer's recommended assembly techniques and procedures
11.02.02	knowledge of equipment application
11.02.03	knowledge of equipment layout
11.02.04	ability to remove protective material
11.02.05	ability to follow assembly instructions
11.02.06	ability to verify assembly of components

Sub-task

11.03 Positions and secures heating, ventilating and air conditioning equipment.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

11.03.01	knowledge of equipment manufacturer's installation techniques and procedures
11.03.02	knowledge of isolation, vibration and seismic requirements
11.03.03	knowledge of service accessibility requirements
11.03.04	knowledge of sequence of positioning and connecting accessories and components
11.03.05	knowledge of types, sizes and function of components and accessories
11.03.06	ability to select equipment location

Supporting Knowledge & Abilities

11.03.07	ability to anchor equipment and components in position
11.03.08	ability to sequence accessories and components
11.03.09	ability to connect components and accessories to manufacturer's specifications
11.03.10	ability to position and secure prefabricated ducting and accessories
11.03.11	ability to verify installation of heating, ventilating and air conditioning equipment
11.03.12	ability to coordinate connection of heating, ventilating and air conditioning systems to utilities

Task 12 Commissions heating, ventilating and air conditioning systems.

Related Components: Installed indoor air quality systems including filtration systems, air cleaners, air distribution systems, sensors and analyzers, air conditioners, heat pumps, installed air distribution systems including ducting, fans, dampers, related controls and sensors, operating refrigeration and air conditioning systems, air distribution systems or heating systems.

Tools and Equipment: Access tools, Allen keys, alignment tools, socket sets, straight edges, trouble lights, two-way radios, common hand tools, air quality testers, ammeters, multi-meters, rulers, smoke testers, tape measures, grease guns, ladders, squares, wrenches, air flow hoods, air volume and pressure test equipment, voltmeters, belt tension indicators, calipers, litmus paper, pump seal kits, levels, slings, psychrometers, manufacturer's specifications, commissioning manuals, caulking guns, vacuum cleaners, carbon monoxide analyzers, clamps, combustion analyzers, draft gauges, flame safeguard testers, flowmeters, simulators, gas pressure gauges, leak detectors, temperature gauges, thermocouple testers, computers, thermometers.

Sub-task

12.01 Performs pre-start-up checks.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

12.01.01	knowledge of manufacturer's recommendations for pre-start inspections and energy sources
12.01.02	knowledge of available energy sources and utilities
12.01.03	knowledge of air psychrometrics
12.01.04	ability to verify energy sources and utilities' connection integrity
12.01.05	ability to verify that equipment specifications match energy sources
12.01.06	ability to verify movement of drives and rotating equipment
12.01.07	ability to make adjustments
12.01.08	ability to complete pre-start-up sheets

Sub-task

12.02 Starts up heating, ventilating and air conditioning systems.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

12.02.01	knowledge of manufacturer's recommended start-up procedures and documentation requirements
12.02.02	knowledge of start-up procedures
12.02.03	knowledge of start-up conditions such as ambient temperatures, pressures, voltage and current
12.02.04	knowledge of equipment application

Supporting Knowledge & Abilities

12.02.05	knowledge of sequence of operation for systems
12.02.06	knowledge of operation of system equipment and components
12.02.07	knowledge of flame characteristics
12.02.08	knowledge of draft characteristics
12.02.09	ability to coordinate activation of energy sources
12.02.10	ability to connect diagnostic instrumentation
12.02.11	ability to follow manufacturer's recommended procedures for start-up
12.02.12	ability to measure operating conditions for heating, ventilating and air conditioning systems
12.02.13	ability to interpret operating conditions for heating, ventilating and air conditioning systems
12.02.14	ability to test operation of safety controls
12.02.15	ability to verify operation of safety controls
12.02.16	ability to make adjustments
12.02.17	ability to verify flame characteristics
12.02.18	ability to document start-up

Task 13 Maintains heating, ventilating and air conditioning systems.

Related Components: Installed indoor air quality systems including filtration systems, air cleaners, air distribution systems, sensors, analyzers, filter medias, consumables and cleanables, exhaust and supply fans, chemical treatments for humidifiers, evaporative condensers; air filtration systems including HEPA filters, water wash filtration equipment, roll filters, standard air filters, high efficiency filters, carbon filters, static filters, electronic air cleaners, sensors, air flow, other containments, exhaust fans, chemical treatments for area of high humidity

and contamination, drain pans, evaporator coils, intake fans, supply air fans, wiring, controls, vanes and dampers; air conditioners, heat pumps; installed air distribution systems including ducting, fans, dampers and related controls and sensors; fire isolation dampers, zone dampers, louvers, grills, diffusers, hangers, insulations, access doors and panels, motorized damper controls; air flow sensors including return air and discharge air temperature sensors; fire alarm systems including smoke alarm and heat rising alarm; electrical connections, wiring, electrical connectors, control connections, motors, drives, bearings, bushings, belts, controls, filters; operating refrigeration and air conditioning systems, including water vaporization systems, electric boilers, propane and/or natural gas boilers, evaporator water systems (drum evaporators, plate evaporators, direct water systems, electronic atomizers, ultrasonic atomizers, water spray systems, steam injection systems), fans, float valves, water pumps, sump pumps, electric motors, humidistat, monitoring gauges, cycling controls, hangers, brackets, water lines, drain lines, electrical supplies, other fuel supplies, wiring, nozzles, cleaning plates, drums, chemical treatments for scale, float systems, water supply systems, filters, piping and tubing; motors and controls including valves, sensors, switches, installed heating systems, including burners, resistance coils/elements, direct fired and indirect fired, heat exchangers, induced draft fans, combustion air motors, electronic valves, controllers, ignition controllers, temperature controls, safety controls, thermocouples, flame rods, glow coils, electrodes, venting, combustion air, orifices, manifolds, dampers, drains, gas valves, pumps, fuel tanks, pressure regulator valves, solenoids, plenum switches, operating controls, thermostat switches, pilot light assemblies, silicon-controlled rectifiers, solid state relays, relays, contactors, sequencers, carbon monoxide sensors, hangers, brackets, racks, utility supply, tubing, wiring, ducting, chimneys, roof curbs, pitch pockets and control wiring; controls including valves, switches and actuators; dampers, manifolds, pressure regulators, heat exchangers, chimneys, ignition devices, flame rods, fans, pumps, nozzles, drive line mechanisms, actuators, zone valves, safety switches.

Tools and Equipment: Access tools, Allen keys, alignment tools, socket sets, straight edges, trouble lights, two-way radios, common hand tools, air quality testers, air volume test equipment, ammeters, multi-meters, rulers, smoke testers, tape measures, bolt cutters, caulking guns, chisels, cloths (sand, emery, sandpaper), crowbars, drills, drill index, electric crimpers, hand carts, hack saws, hole saws, insulation tapes, knock-out kits, labelling machines, ladders, pry bars, saws, squares, tin snips, utility knives, wrenches, hoisting and rigging equipment, grease guns, air flow hoods, belt tension indicators, calipers,

hoses, levels, powder-actuated tools, air volume test equipment, voltmeters, litmus paper, pump seal kits, slings, psychrometers, air fuel equipment, bending jigs, bending tools and springs, brazing equipment, pipe cutters, tube cutters, water analysis kits, manufacturer's specifications, commissioning manuals, vacuum cleaners, carbon monoxide analyzers, clamps, combustion analyzers, draft gauges, flame safeguard testers, flow meters, simulators, gas pressure gauges, leak detectors, temperature gauges, thermocouple testers, thermometers, conduit benders, flaring tools, hazardous waste containers, pipe dies, pipe threaders, tap and die sets.

Sub-task

13.01 Inspects heating, ventilating and air conditioning systems.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

13.01.01 knowledge of components of heating, ventilating and air conditioning systems

13.01.02 knowledge of equipment specifications and limitations

13.01.03 knowledge of equipment and system design

13.01.04 knowledge of inspection procedures and techniques

13.01.05 ability to conduct visual, physical, odour and noise examination of equipment for worn, damaged or fouled components

13.01.06 ability to recognize loose, worn, damaged or fouled components

13.01.07 ability to recommend corrective action

Sub-task

13.02 Tests electrical/electronic components in heating, ventilating and air conditioning systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

13.02.01	knowledge of electricity principles
13.02.02	knowledge of electric and electronic test instruments
13.02.03	knowledge of types of components
13.02.04	knowledge of equipment electrical and electronic specifications
13.02.05	knowledge of equipment operation
13.02.06	knowledge of test procedures and techniques
13.02.07	ability to simulate a condition
13.02.08	ability to operate test instruments
13.02.09	ability to isolate electrical/electronic fault
13.02.10	ability to interpret and report test results

Sub-task

13.03 Tests mechanical components in heating, ventilating and air conditioning systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

13.03.01	knowledge of mechanical test instruments
13.03.02	knowledge of types of components
13.03.03	knowledge of equipment specifications
13.03.04	knowledge of equipment operation

Supporting Knowledge & Abilities

13.03.05	knowledge of test procedures and techniques
13.03.06	ability to simulate an environmental condition
13.03.07	ability to operate test equipment/instruments
13.03.08	ability to isolate mechanical fault
13.03.09	ability to interpret and report test results

Sub-task

13.04 Recommends corrective action.

NL	NS	PE	NB	PQ	ON	MA	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

13.04.01	knowledge of repair/replacement procedures
13.04.02	knowledge of repair/replacement alternatives/options
13.04.03	knowledge of potential consequences of recommended action
13.04.04	knowledge of company repair/replacement policies
13.04.05	knowledge of warranties and maintenance agreements
13.04.06	ability to estimate repair/replacement costs
13.04.07	ability to determine repair options
13.04.08	ability to report fault and explain options to end user
13.04.09	ability to secure approval
13.04.10	ability to schedule repair
13.04.11	ability to prepare report

Sub-task

13.05 Selects heating, ventilating and air conditioning equipment and components.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

13.05.01 knowledge of heating, ventilating and air conditioning systems' equipment/component specifications such as voltages and sizes

13.05.02 knowledge of heating, ventilating and air conditioning systems' equipment sources and availability

13.05.03 knowledge of equipment alternatives such as original equipment manufacturer or generic

13.05.04 knowledge of company acquisition policies such as preferred suppliers and purchasing procedures

13.05.05 knowledge of time constraints

13.05.06 ability to order equipment/components

13.05.07 ability to evaluate equipment options

13.05.08 ability to evaluate logistical requirements such as transportation

13.05.09 ability to fabricate components such as brackets, hangers and mounts

Sub-task

13.06 Replaces defective heating, ventilating and air conditioning components and equipment.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

13.06.01 knowledge of required replacement procedures/techniques

Supporting Knowledge & Abilities

13.06.02 knowledge of tools, equipment and resources required to complete job

13.06.03 knowledge of components and equipment limitations/specifications such as weight, capacity, voltages and programming

13.06.04 ability to schedule required equipment, human resources, tools and material

13.06.05 ability to source required tools, resources and equipment such as cranes, helicopter and lifts

13.06.06 ability to transport or arrange transportation of required tools and equipment to job site

13.06.07 ability to shut down system

13.06.08 ability to isolate/lock out and tag out system

13.06.09 ability to access equipment and components

13.06.10 ability to dismantle equipment

13.06.11 ability to assemble equipment

13.06.12 ability to adjust equipment/components

Sub-task

13.07 Repairs/overhauls defective components and equipment for heating, ventilating and air conditioning systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

13.07.01 knowledge of repair/overhaul procedures and techniques

13.07.02 knowledge of equipment/component specifications including tolerances and limitations

13.07.03 ability to interpret manufacturer's specifications

Supporting Knowledge & Abilities

13.07.04	ability to recommend adjustments
13.07.05	ability to shut down system
13.07.06	ability to isolate/lock out and tag out system
13.07.07	ability to dismantle equipment
13.07.08	ability to assemble equipment

Sub-task

13.08 Verifies heating, ventilating and air conditioning systems and component function.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

13.08.01	knowledge of heating, ventilating and air conditioning systems equipment/component operation/function
13.08.02	knowledge of test equipment for heating, ventilating and air conditioning systems
13.08.03	knowledge of original design parameters
13.08.04	knowledge of equipment specifications such as capacity, voltages and sequence
13.08.05	ability to simulate an environmental condition
13.08.06	ability to test component operation for functionality
13.08.07	ability to interpret specifications
13.08.08	ability to interpret and report test results

Sub-task

13.09 Performs predictive maintenance on heating system.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	no	NV	NV	NV

13.09.01 knowledge of system analyzing and testing procedures

13.09.02 ability to conduct system analysis and testing procedures

Sub-task

13.10 Performs preventative maintenance on heating, ventilating and air conditioning systems.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

13.10.01 knowledge of preventative maintenance requirements such as schedule and manufacturer's recommendations

13.10.02 knowledge of preventative maintenance procedures

13.10.03 knowledge of local water conditions

13.10.04 ability to assess the need to replace consumables

13.10.05 ability to replace consumables such as belts, filters, cylinders and elements

13.10.06 ability to conduct maintenance activities such as cleaning, lubricating, tightening and adjusting

13.10.07 ability to check flame characteristics

13.10.08 ability to return system to operation

BLOCK D

CONTROL SYSTEMS

Trends: *Increased use of electronic and microprocessing systems for controlling systems, data acquisition and logging use of computers, printers, software for control systems, printer access for system monitoring and adjustments, decrease in pneumatic and mechanical controls, increased sophisticated electronic controls, throw away control components, increased building automation controls and more automatic controls.*

Task 14 Plans installation of control systems.

Related Components: Microprocessors, sensors, transducers, controllers, software, ammeters, cables, transmitters, actuators, solenoids, sequencers, pneumatic compressors, air dryers, receivers, water separators, pressure regulators PE switches, pressure switches, tubing, air switches, thermostats, high limits, low limits, timers, time clocks, level switches, proximity switches, gauges, micro switches.

Tools and Equipment: Manufacturer's specifications, design criteria and parameters, calculators.

Sub-task

14.01 Selects controls.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

14.01.01 knowledge of end user requirements

14.01.02 knowledge of trade standards such as ASHRAE

14.01.03 knowledge of types and applications of controls such as electric, electronic, pneumatic and direct digital controls (DDC)

14.01.04 knowledge of manufacturer's specifications

14.01.05 knowledge of control fundamentals and strategies

14.01.06 knowledge of system control requirements

Supporting Knowledge & Abilities

14.01.07	knowledge of control programming methods
14.01.08	ability to specify design criteria and parameters
14.01.09	ability to outline sequence of operations of control system
14.01.10	ability to assess compatibility of controls with a system
14.01.11	ability to choose controls to match application

Sub-task

14.02 Lays out control system components and wiring.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

Supporting Knowledge & Abilities

14.02.01	knowledge of installation methods and requirements
14.02.02	knowledge of wiring and connecting methods and procedures
14.02.03	knowledge of equipment function and operation
14.02.04	knowledge of sequence of operations of control system
14.02.05	knowledge of layout techniques and terminology
14.02.06	ability to assess electrical requirements of control system
14.02.07	ability to optimize control system functions
14.02.08	ability to produce a layout plan

Task 15 Installs control systems.

Related Components: Microprocessors, sensors, transducers, controllers, software, ammeters, cables, transmitters, actuators, solenoids, sequencers, pneumatic compressors, air dryers, receivers, water separators, pressure regulators PE switches, pressure switches, tubing, air switches, thermostats, high limits, low limits, timers, time clocks, level switches, proximity switches, gauges, micro switches.

Tools and Equipment: Access tools, Allen keys, bending tools and springs, brazing equipment, calculators, cloths (sand, emery, sandpaper), computers, conduit benders, drills (hand, electric, cordless), electrical crimpers, fish tapes, flaring tools, funnels, fuse pullers, hole saws, hoses, knock-out kits, labelling machines, ladders, local interfaces, pipe cutters, Pitot tubes, printers, socket sets, soldering equipment, tin snips, trouble lights, two-way radios, utility knives, vacuum cleaners, wrenches, common hand tools, manufacturer's manuals.

Sub-task

15.01 Prepares site/location for control system.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

15.01.01 knowledge of available locations for control panels and components

15.01.02 knowledge of installation requirements related to utilities such as communication network and electrical

15.01.03 knowledge of control system operation and application

15.01.04 ability to schedule project activities related to sub-trades and end user deadlines

15.01.05 ability to calculate labour requirements

15.01.06 ability to schedule project teams

15.01.07 ability to schedule connection of control system to utilities

Sub-task

15.02 Positions and secures control system components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

15.02.01	knowledge of equipment manufacturer's recommended installation techniques and procedures
15.02.02	knowledge of equipment application
15.02.03	knowledge of isolation and vibration requirements
15.02.04	knowledge of service accessibility requirements
15.02.05	knowledge of sequence of positioning and connecting accessories and components
15.02.06	knowledge of types, sizes and function of components and accessories
15.02.07	ability to anchor components in position
15.02.08	ability to sequence accessories and components
15.02.09	ability to connect components and accessories to manufacturer's specifications
15.02.10	ability to verify installation of control system components
15.02.11	ability to coordinate connection of control system to utilities

Sub-task

15.03 Connects system wiring and tubing.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

15.03.01	knowledge of equipment manufacturer's specifications, procedures and techniques for installing control systems
15.03.02	knowledge of electrical noise interference
15.03.03	knowledge of types, sizes and capacities of tubing
15.03.04	knowledge of tube routing techniques and company's labelling strategies
15.03.05	ability to terminate mechanical connections
15.03.06	ability to label/tag controls, wiring and tubing

Task 16 Commissions control systems.

Related Components: Installed refrigeration and air conditioning systems, air handling systems, heating systems.

Tools and Equipment: Manufacturer's specifications, commissioning manuals, access tools, Allen keys, calculators, fuse pullers, ladders, local interfaces, printers, socket sets, trouble lights, two-way radios, vacuum cleaners, wrenches, levels, common hand tools, air flow hoods, air quality testers, air volume test equipment, ammeters anemometers, belt tension indicators, calipers, carbon dioxide analyzers, carbon monoxide analyzers, clamps, multi-meters, milliammeters, potentiometers, simulators, slings, psychrometers, laptop computers, leak detectors, magnahelics, micrometers, manometers, temperature gauges, thermocouple testers, thermometers, transducers, velometers, wattmeters.

Sub-task

16.01 Performs pre-start-up checks.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

16.01.01	knowledge of manufacturer's recommendations for pre-start inspections and sources of energy
16.01.02	knowledge of site specific conditions such as controller, sensor, computer and actuator locations
16.01.03	knowledge of available energy sources
16.01.04	ability to verify energy sources and connection integrity
16.01.05	ability to comply with equipment specifications
16.01.06	ability to verify movement of drives and rotating equipment
16.01.07	ability to check isolation devices, disconnect switches and valves
16.01.08	ability to verify required voltage
16.01.09	ability to verify completion of controls, wiring and tubing
16.01.10	ability to make adjustments
16.01.11	ability to complete pre-start-up sheets

Sub-task

16.02 Sets operating parameters.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

16.02.01	knowledge of site-specific operating parameters

Supporting Knowledge & Abilities

16.02.02	knowledge of manufacturer's programming and configuration
16.02.03	ability to program controllers such as microprocessors, timers and analog control systems
16.02.04	ability to verify operating parameters
16.02.05	ability to interpret control system's specifications

Sub-task

16.03 Starts up control system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

16.03.01	knowledge of manufacturer's recommended start-up procedures and documentation requirements
16.03.02	knowledge of start-up procedures
16.03.03	knowledge of equipment application
16.03.04	knowledge of sequence of operation for system
16.03.05	knowledge of operation of system equipment and components
16.03.06	ability to coordinate activation of energy source
16.03.07	ability to connect diagnostic instrumentation
16.03.08	ability to follow manufacturer's recommended procedures for start-up
16.03.09	ability to make adjustments
16.03.10	ability to verify safety and operating controls
16.03.11	ability to document start-up
16.03.12	ability to create and save a backup file

Task 17 Maintains control systems.

Related Components: Installed refrigeration and air conditioning systems, microprocessors, sensors, transducers, controllers, software, ammeters, cables, transmitters, actuators, solenoids, sequencers, pneumatic compressors, air dryers, receivers, water separators, pressure regulators, PE switches, pressure switches, tubing, air switches, thermostats, high limits, low limits, timers, time clocks, level switches, proximity switches, gauges, micro switches, air compressors, filters, water traps, oils, motors and linkages, electrical connectors, mechanical connectors including levers, links, chains, pulleys, belts, filters for sensors.

Tools and Equipment: Manufacturer's specifications, commissioning manuals, access tools, Allen keys, calculators, fuse pullers, ladders, local interfaces, printers, socket sets, trouble lights, two-way radios, vacuum cleaners, wrenches, levels, common hand tools, air flow hoods, air quality testers, air volume test equipment, ammeters, anemometers, calipers, carbon dioxide analyzers, carbon monoxide analyzers, clamps, multi-meters, milliammeters, pneumatic calibration kits, potentiometers, simulators, slings, psychrometers, laptop computers, leak detectors, magnahelics, manometers, temperature gauges, thermocouple testers, thermometers, transducers, velometers, wattmeters, bending tools and springs, brazing equipment, cloths (sand, emery, sandpaper), computers, conduit benders, drills (hand, electric, cordless), electrical crimpers, fish tapes, flaring tools, funnels, fuse pullers, hole saws, hoses, knock-out kits, labelling machines, pipe cutters, Pitot tubes, soldering equipment, tin snips, utility knives, belt tension indicators, micrometers.

Sub-task

17.01 Inspects control system.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

17.01.01 knowledge of components of control system

17.01.02 knowledge of equipment specifications and limitations

17.01.03 knowledge of equipment and system design

17.01.04 knowledge of inspection procedures and techniques

Supporting Knowledge & Abilities

17.01.05	ability to conduct visual, physical, odour and noise examination of equipment for worn, damaged or fouled components
17.01.06	ability to recognize loose, worn, damaged or fouled components
17.01.07	ability to recommend corrective action

Sub-task

17.02 Verifies and resets operating parameters.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

17.02.01	knowledge of electricity, pneumatic and hydraulic principles
17.02.02	knowledge of test instruments
17.02.03	knowledge of operating parameters
17.02.04	knowledge of control strategies such as PID loops, proportional control and on/off control
17.02.05	knowledge of manufacturer's specifications, tolerances and ranges
17.02.06	knowledge of interface equipment
17.02.07	ability to interface devices
17.02.08	ability to simulate conditions such as temperature, current or voltage
17.02.09	ability to test and confirm functionality
17.02.10	ability to adjust parameters such as set points, differentials, scheduling and sequences

Sub-task

17.03 Tests electrical/electronic components in control system.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

17.03.01	knowledge of electricity principles
17.03.02	knowledge of electric and electronic test instruments
17.03.03	knowledge of types of control system components
17.03.04	knowledge of equipment's electrical and electronic specifications
17.03.05	knowledge of equipment operation
17.03.06	knowledge of test procedures and techniques including voltage, amperage and ohm tests
17.03.07	ability to operate test instruments
17.03.08	ability to simulate a condition
17.03.09	ability to isolate electrical/electronic fault
17.03.10	ability to interpret and report test results

Sub-task

17.04 Tests mechanical components in control system.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

17.04.01	knowledge of mechanical test instruments
17.04.02	knowledge of types of components
17.04.03	knowledge of equipment specifications
17.04.04	knowledge of equipment operation

Supporting Knowledge & Abilities

17.04.05	knowledge of test procedures and techniques
17.04.06	ability to operate test equipment
17.04.07	ability to isolate a mechanical fault
17.04.08	ability to simulate an environmental condition
17.04.09	ability to interpret and report test results

Sub-task

17.05 Recommends corrective action.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

17.05.01	knowledge of repair/replacement procedures
17.05.02	knowledge of repair/replacement alternatives/options
17.05.03	knowledge of criteria such as cost, time and availability of equipment
17.05.04	knowledge of potential consequences of recommended action
17.05.05	knowledge of company repair/replacement policies
17.05.06	knowledge of warranties and maintenance agreements
17.05.07	ability to estimate repair/replacement costs
17.05.08	ability to determine repair options
17.05.09	ability to report fault and explain options to end user
17.05.10	ability to secure approval
17.05.11	ability to schedule repair
17.05.12	ability to prepare report

Sub-task

17.06 Selects control system equipment and components.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

17.06.01	knowledge of control system equipment/component specifications such as voltages and sizes
17.06.02	knowledge of control system equipment sources and availability
17.06.03	knowledge of equipment alternatives such as original equipment manufacturer or generic
17.06.04	knowledge of company policies such as preferred suppliers and purchasing
17.06.05	knowledge of time constraints
17.06.06	ability to coordinate ordering of equipment/components
17.06.07	ability to evaluate equipment options
17.06.08	ability to evaluate logistical requirements such as shipping
17.06.09	ability to expedite orders
17.06.10	ability to fabricate components such as brackets, hangers and mounts

Sub-task

17.07 Replaces defective control components and equipment.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

17.07.01	knowledge of required replacement procedures/techniques
17.07.02	knowledge of tools, equipment and resources required to complete job

Supporting Knowledge & Abilities

17.07.03	knowledge of equipment limitations/specifications such as weight, capacity, voltages and programming
17.07.04	ability to schedule required equipment, human resources, tools and materials
17.07.05	ability to source required tools, resources and equipment such as meters, gauges and recorders
17.07.06	ability to transport or arrange transportation of required tools and equipment to job site
17.07.07	ability to shut down system
17.07.08	ability to isolate/lock out and tag out system
17.07.09	ability to access equipment and components
17.07.10	ability to dismantle equipment
17.07.11	ability to assemble equipment
17.07.12	ability to adjust equipment/components

Sub-task

17.08 Repairs/overhauls defective components and equipment for control system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

17.08.01	knowledge of repair/overhaul procedures and techniques
17.08.02	knowledge of equipment/component specifications including tolerances and limitations
17.08.03	ability to interpret manufacturer's specifications
17.08.04	ability to recommend adjustments
17.08.05	ability to shut down system

Supporting Knowledge & Abilities

17.08.06	ability to isolate/lock out and tag out system
17.08.07	ability to dismantle equipment
17.08.08	ability to assemble parts
17.08.09	ability to override/bypass controls
17.08.10	ability to reprogram and adjust control system
17.08.11	ability to create backup of data
17.08.12	ability to restore original parameters

Sub-task

17.09 Verifies control system component function.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

17.09.01	knowledge of control system equipment/component operation/function
17.09.02	knowledge of test equipment for control systems
17.09.03	knowledge of original design parameters
17.09.04	knowledge of equipment specifications such as capacity, voltages and sequence
17.09.05	knowledge of calibration techniques and procedures
17.09.06	knowledge of interface equipment such as computers, microprocessors and hand-held modules
17.09.07	knowledge of implications/possible consequences of adjustments to items such as set points, schedules and sequences
17.09.08	ability to simulate fault conditions

Supporting Knowledge & Abilities

17.09.09	ability to test component operation for functionality
17.09.10	ability to interpret specifications
17.09.11	ability to interpret and report test results
17.09.12	ability to override/bypass controls
17.09.13	ability to calibrate controllers and transmitters
17.09.14	ability to utilize interface equipment
17.09.15	ability to adjust parameters such as set points, differentials, scheduling and sequences

Sub-task

17.10 Performs preventative maintenance on control system.

Supporting Knowledge & Abilities

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

17.10.01	knowledge of preventative maintenance requirements such as schedule and manufacturer's recommendations
17.10.02	knowledge of preventative maintenance procedures
17.10.03	ability to assess the need to replace consumables
17.10.04	ability to replace consumables such as filters and batteries
17.10.05	ability to conduct maintenance activities such as cleaning, lubricating, tightening and adjusting
17.10.06	ability to return system to operation

Sub-task

17.11 Calibrates operating and safety controls.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

17.11.01	knowledge of operation of control systems
17.11.02	knowledge of testing and calibration procedures and techniques
17.11.03	ability to test operating and safety controls for range of calibration
17.11.04	ability to calibrate controls to specified range
17.11.05	ability to calibrate controllers and transmitters

APPENDICES

TOOLS AND EQUIPMENT

access tool
air compressor and regulator
air fuel equipment
Allen keys
alignment tools
bending jig
bending tools and springs
black light
bolt cutter
brazing equipment
brush (wire, paint, acid, tube)
calculator
carbon dioxide (CO_2) cylinder and regulator
caulking gun
chalk line
charging manifold
charging cylinder
chisels
circulating pump
cloth: sand, emery, sandpaper
computer
conduit bender
crowbar
drill index
drills (hand, electric, cordless)
electrical crimpers
fin combs
fish tape
flaring tools
funnel
fuse puller
glue gun
graduated cylinder
grease gun
ground fault detectors
hand cart
hand folding pliers
hand sprayer
hazardous waste container
hack saw
hole saws
hose
Johnson bar
knock-out kit
labelling machine
ladders
levels (laser, bubble, water, precision, line, transit)
litmus paper
local interfaces
nitrogen cylinder and regulator
O-ring removal tool
oxy-fuel equipment
orifice drill set
padlock
paint rollers and brushes
pipe cutters
pipe dies
pipe threaders
Pitot tube
powder-actuated tools
power washer
printer
pry bar
pullers
pump seal kits
punch
purging unit
reamer
recovery/recycle unit
refrigerant oil pump
refrigerant scale
retrieval and storage equipment
router
saws (power/electric, jig, reciprocating, band)
scrapers
screw extractors
socket sets
soldering equipment (iron/gun)
squares
stapler
straight edge
swaging tools
tap and die set
tin snips
transfer pump
trouble light
tube cutter
two way radios
utility knife
vacuum cleaner
vacuum pump
wrenches (pipe, open end, adjustable, Allen, valve, torque)

Tool Kit
(Common hand tools carried by mechanic)

cutters (side, wire)
files
flashlight
hammer
line level
mirror
nut drivers
pliers
Schrader remover
screwdrivers
tape measure
wire strippers
wrenches

Hoisting and Rigging Equipment

block and tackle
chains and cables
chain fall
come-along
crane
dollies
eye bolts
fork lift
genie lift
hoist
j-bar
jacks (hydraulic, mechanical)
platform lifts
rope
scaffolding
shackles
slings
staging
winch

Measuring and Testing Instruments

air flow hood
air quality tester
air volume test equipment
ammeter
anemometer (vane, hot wire)
belt tension indicator
calculator
callipers
capacitor tester
carbon dioxide analyzer
carbon monoxide analyzer
clamp multimeter
combustion analyzer
computerized diagnostic equipment
compound gauge
data loggers
decibel meter
dial indicator
draft gauge
dye penetrant kit
eddy current tester
feeler gauges
flame safeguard tester
flowmeter
frequency meter
gas pressure gauge
hydrometer
hygrometer
infrared thermography camera and display unit
laptop computer
leak detectors (electronic, ultrasonic, halide, soap tests, litmus test, sulphur test, ultraviolet)
local interfaces
magnahelic gauge
manifold gauge set
manometers (U-tube, incline, electronic)
megger
micrometers
micron gauge (mechanical, electronic)
milliammeter
multimeter
oil test kit
oxygen analyzer

pH testing kit
phase meter (mechanical, electronic)
Pitot tube
pneumatic calibration kit
potentiometer
refractometers
ruler
simulators (temperature, voltage, humidity, current, pressure)
sling psychrometer
smoke tester
sound level meter
spectrometer
stethoscope
strobe light
tachometer
tape measure
temperature gauge
thermocouple tester
thermometers (infrared, electronic, mechanical)
transducers (humidity, pressure, amps, current, voltage)
vacuum gauge
velometer
vernier calipers
vibration analysis equipment
water analysis kit
wattmeter
weigh scales (mechanical, electronic)

First Aid and Safety Equipment

apron
barricades/guard rails/pylons
fire blanket
fire extinguisher
first aid kit/station
gloves (rubber, insulated, fitter)
hard hat
hearing protection (plugs, muffs)
lock-out kit
mask (dust, particle, filter)
rain suit
respirator
rubber boots
safety boots
safety face shield
safety glasses
safety goggles
safety harness
warning signs

BLOCKS AND TASKS WEIGHTING

BLOCK A FUNDAMENTAL OCCUPATIONAL SKILLS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	National Average
%	15	20	20	20	10	5	20	15	5	10	NV	NV	NV	14%

Task 1 Utilizes mechanical and architectural drawings, acts, codes, standards, legislation and service, and operating manuals.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	18	5	15	17	40	5	20	10	40	20	NV	NV	NV	19%

Task 2 Operates and maintains tools and equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	19	30	15	18	20	45	20	25	5	15	NV	NV	NV	21%

Task 3 Demonstrates work practices and procedures.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	25	30	20	20	10	40	30	33	40	15	NV	NV	NV	26%

Task 4 Coordinates refrigeration and air conditioning installation and maintenance.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	28	30	40	25	20	5	20	22	15	40	NV	NV	NV	25%

Task 5 Performs system components, accessories and materials acquisition and handling.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	10	5	10	20	10	5	10	10	0	10	NV	NV	NV	9%

BLOCK B REFRIGERATION AND AIR COOLING SYSTEMS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	National Average
%	33	35	30	24	35	55	35	44	55	30	NV	NV	NV	38%

Task 6 Plans installation of refrigeration and air cooling systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	18	10	15	13	10	20	15	18	0	25	NV	NV	NV	14%

Task 7 Installs refrigeration and air cooling systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	25	35	35	30	20	30	30	29	30	25	NV	NV	NV	29%

Task 8 Commissions refrigeration and air cooling systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	22	20	20	30	40	30	20	24	20	25	NV	NV	NV	25%

Task 9 Maintains refrigeration and air cooling systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	35	35	30	27	30	20	35	29	50	25	NV	NV	NV	32%

BLOCK C HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	National Average
%	32	35	30	30	35	25	30	23	25	30	NV	NV	NV	29%

Task 10 Plans installation of heating, ventilating and air conditioning systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	13	10	15	10	10	20	15	19	0	25	NV	NV	NV	14%

Task 11 Installs heating, ventilating and air conditioning systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	27	35	35	30	20	30	30	23	20	25	NV	NV	NV	27%

Task 12 Commissions heating, ventilating and air conditioning systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	23	20	20	30	40	30	20	28	20	25	NV	NV	NV	26%

Task 13 Maintains heating, ventilating and air conditioning systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	37	35	30	30	30	20	35	30	60	25	NV	NV	NV	33

BLOCK D CONTROL SYSTEMS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	National Average
%	20	10	20	26	20	15	15	18	15	30	NV	NV	NV	19%

Task 14 Plans installation of control systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	13	10	25	13	10	10	15	20	0	25	NV	NV	NV	14%

Task 15 Installs control systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	34	35	20	30	20	10	25	20	25	15	NV	NV	NV	23%

Task 16 Commissions control systems.

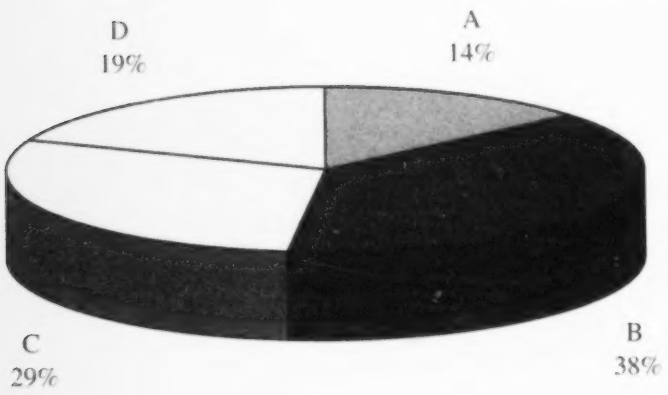
	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	23	20	20	30	35	20	25	33	25	30	NV	NV	NV	26%

Task 17 Maintains control systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	NU	
%	30	35	35	27	35	60	35	27	50	30	NV	NV	NV	37%

PIE CHART*

Refrigeration and Air Conditioning Mechanic



TITLE OF BLOCKS

Block A	Fundamental Occupational Skills	Block C	Heating, Ventilating and Air Conditioning Systems
Block B	Refrigeration and Air Cooling Systems	Block D	Control Systems

* The average percentage of the total number of questions on an interprovincial examination, assigned to assess each block of the analysis, as derived from the collective input from workers within the occupation from all areas of Canada. Interprovincial examinations typically have from 100 up to 150 multiple choice questions on each examination.

REFRIGERATION AND AIR CONDITIONING MECHANIC (2004)

BLOCKS | **TASKS** | **SUB-TASKS** →

	BLOCKS	TASKS	SUB-TASKS
A	**Fundamental Occupational Skills**	**1.** Utilizes mechanical and architectural drawings, acts, codes, standards, legislation, and service and operating manuals.	1.01 Interprets blueprints, drawings and schematics. 1.02 Interprets service and operating manuals, technical bulletins and warranties. 1.03 Interprets tables, charts and diagrams. 1.04 Interprets manufacturer's specifications. 1.05 Complies with government acts, codes, standards and regulations.
		2. Operates and maintains tools and equipment.	2.01 Utilizes hand tools. 2.02 Utilizes portable and stationary power tools. 2.03 Utilizes oxy-fuel and air-fuel equipment. 2.04 Utilizes recovery and recycle equipment. 2.05 Utilizes evacuation equipment and tools. 2.06 Utilizes charging equipment and tools. 2.07 Utilizes access/egress equipment. 2.08 Utilizes hoisting and rigging equipment. 2.09 Utilizes mechanical measuring equipment. 2.10 Utilizes electric and electronic diagnostic tools. 2.11 Utilizes computer equipment to interface with refrigeration and air conditioning systems.
		3. Demonstrates work practices and procedures.	3.01 Installs fasteners, brackets and hangers. 3.02 Performs lock-out tagging and isolation procedures. 3.03 Installs piping and tubing. 3.04 Applies sealants and adhesives. 3.05 Cleans and lubricates parts and components. 3.06 Performs internal electrical wiring of systems.
		4. Coordinates refrigeration and air conditioning installation and maintenance.	4.01 Estimates work requirements. 4.02 Conducts work area inspection. 4.03 Coordinates work requirements. 4.04 Maintains customer relations. 4.05 Clarifies end user problems with refrigeration and air conditioning systems. 4.06 Completes work-related documentation. 4.07 Generates maintenance documentation.
		5. Performs system components, accessories and materials acquisition and handling.	5.01 Requisitions equipment. 5.02 Receives materials/equipment. 5.03 Transfers equipment to designated location.
B	**Refrigeration and Air Cooling Systems**	**6.** Plans installation of refrigeration and air cooling systems.	6.01 Verifies refrigeration and air cooling system parameters and requirements. 6.02 Selects refrigeration and air cooling components, equipment and accessories. 6.03 Prepares components, equipment and accessories layout. 6.04 Selects refrigerant. 6.05 Sizes piping. 6.06 Lays out piping. 6.07 Selects insulation.
		7. Installs refrigeration and air cooling systems.	7.01 Prepares site/location. 7.02 Assembles refrigeration and air cooling components, equipment and accessories. 7.03 Positions and secures refrigeration and air cooling components, equipment and accessories. 7.04 Routes and connects refrigerant piping. 7.05 Performs leak test on system. 7.06 Evacuates system. 7.07 Charges system.

REFRIGERATION AND AIR CONDITIONING MECHANIC (2004)

BLOCKS	TASKS	SUB-TASKS									
	8. Commissions refrigeration and air cooling systems.	8.01 Performs pre-start-up checks.	8.02 Starts up refrigeration and air conditioning system.	8.03 Completes system charge.	8.04 Sets up primary and secondary refrigeration system adjustable switches, valves and regulators.						
	9. Maintains refrigeration and air cooling systems.	9.01 Inspects refrigeration and air cooling systems.	9.02 Tests electrical and electronic components.	9.03 Tests mechanical components.	9.04 Recommends corrective action.	9.05 Selects refrigeration and air cooling equipment and components.	9.06 Replaces defective components and equipment.	9.07 Repairs/overhauls defective components and equipment.	9.08 Verifies refrigeration and air cooling system and component function.	9.09 Performs predictive maintenance.	9.10 Performs preventative maintenance.
C **Heating, Ventilating and Air Conditioning Systems**	**10.** Plans installation of heating, ventilating and air conditioning systems.	10.01 Verifies heating, ventilating and air conditioning systems, parameters and requirements.	10.02 Selects heating, ventilating and air conditioning components and equipment.	10.03 Confirms heating, ventilating and air conditioning requirements.							
	11. Installs heating, ventilating and air conditioning systems.	11.01 Prepares heating, ventilating and air conditioning equipment site/location.	11.02 Assembles heating, ventilating and air conditioning equipment.	11.03 Positions and secures heating, ventilating and air conditioning equipment.							
	12. Commissions heating, ventilating, and air conditioning systems.	12.01 Performs pre-start-up checks.	12.02 Starts up heating, ventilating and air conditioning systems.								
	13. Maintains heating, ventilating, and air conditioning systems.	13.01 Inspects heating, ventilating and air conditioning systems.	13.02 Tests electrical/electronic components in heating, ventilating and air conditioning systems.	13.03 Tests mechanical components in heating, ventilating and air conditioning systems.	13.04 Recommends corrective action.	13.05 Selects heating, ventilating and air conditioning equipment and components.	13.06 Replaces defective heating, ventilating and air conditioning components and equipment.	13.07 Repairs/overhauls defective components and equipment for heating, ventilating and air conditioning systems.	13.08 Verifies heating, ventilating and air conditioning systems and component function.	13.09 Performs predictive maintenance on heating system.	13.10 Performs preventative maintenance on heating, ventilating and air conditioning systems.
D **Control Systems**	**14.** Plans installation of control systems.	14.01 Selects controls.	14.02 Lays out control system components and wiring.								

REFRIGERATION AND AIR CONDITIONING MECHANIC (2004)

BLOCKS	TASKS	SUB-TASKS										
	15. Installs control systems.	15.01 Prepares site/location for control system.	15.02 Positions and secures control system components.	15.03 Connects system wiring and tubing.								
	16. Commissions control systems.	16.01 Performs pre-start-up checks.	16.02 Sets operating parameters.	16.03 Starts up control system.								
	17. Maintains control systems.	17.01 Inspects control system.	17.02 Verifies and resets operating parameters.	17.03 Tests electrical/ electronic components in control system.	17.04 Tests mechanical components in control system.	17.05 Recommends corrective action.	17.06 Selects control system equipment and components.	17.07 Replaces defective control components and equipment.	17.08 Repairs/overhauls defective components and equipment for control system.	17.09 Verifies control system component function.	17.10 Performs preventative maintenance on control system.	17.11 Calibrates operating and safety controls.